MAY

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

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Anesthesia in Exodontia—*Henahan*
Periodic Treatment of Malocclusion—*Willett*
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EDITORIAL

American Public Health Association
DENTAL HEALTH EDUCATION
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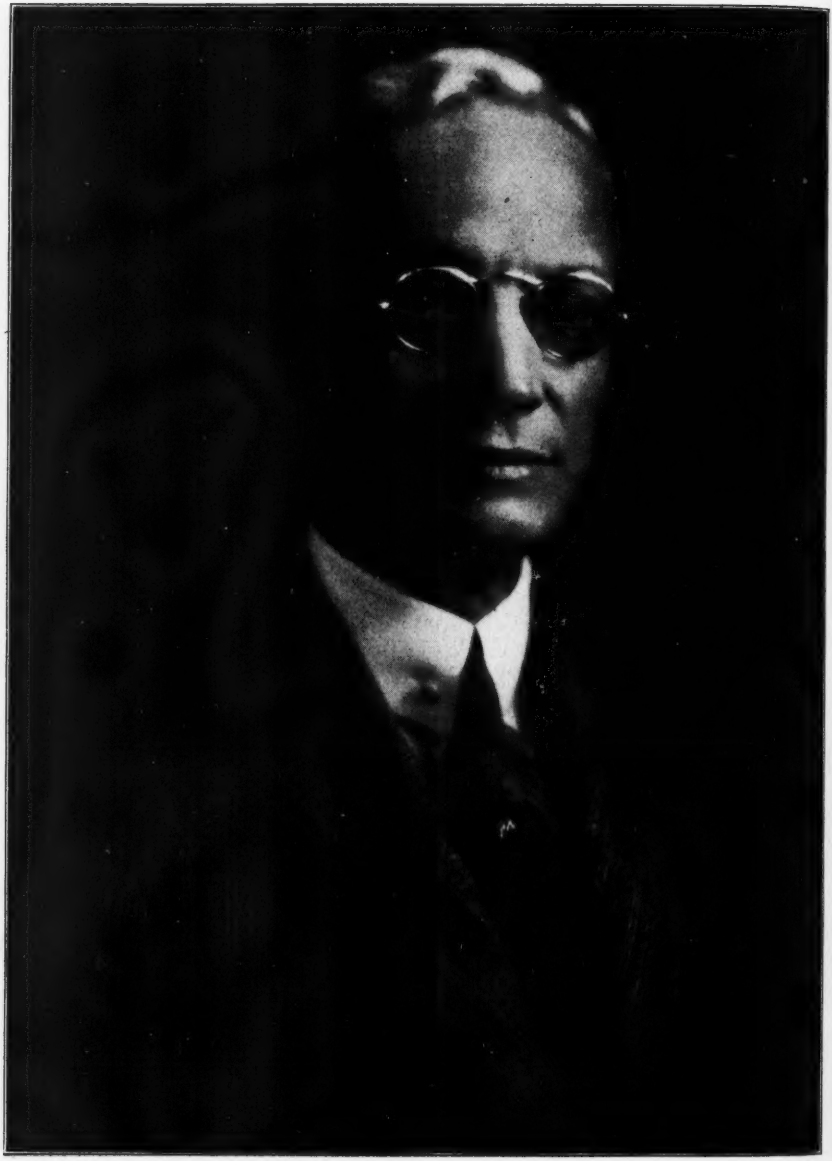

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Original Communications

SOME ABNORMAL FUNCTIONS ASSOCIATED WITH MALOCCLUSION*

By LLOYD S. LOURIE, D.D.S., Chicago, Illinois

IN considering the subject of abnormal functions associated with malocclusion, it is not the intention to discuss general bodily or physiologic functions such as nutritional and endocrine disturbances, and they are only mentioned that their importance may not be overlooked while attention is being given to local conditions in and about the mouth.

Naturally, in connection with malocclusion, one thinks of defective mastication, mouth-breathing, and finger or thumb sucking; but in addition there are various malfunctions or habits of lips, cheeks and tongue, and particularly the tongue, which are sometimes overlooked. Any of these abnormal functions mentioned may be a cause of malocclusion, either primary, secondary or concurrent, or it may be a result. It may consist of an insufficiency or a perversion of function.

In all cases, it is necessary that these conditions as well as the malocclusion be corrected to insure permanency of improved occlusion and give the patient the full benefits of orthodontic treatment. Patients and parents should be impressed with the futility of orthodontic treatment or at least its limitations unless these bad habits are arrested and normal functions established but I do not agree with one of my friends who says that habits of perverted function should be corrected before beginning orthodontic treatment. Some of them can be corrected independently, but some of them could not possibly be corrected while certain forms of malocclusion exist, and some are automatically corrected with the malocclusion, so they should be treated together. The sucking habits are most persistent, some

*Read before the Midwinter Clinic of the Chicago Dental Society, Jan. 27, 1927.

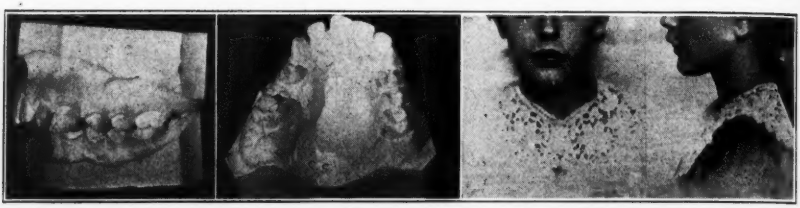

Fig. 1 (Case 1).—Thumb sucking with protrusion of the upper teeth.

individuals keeping them up to maturity. One of the first things some babies do is to put the thumb in the mouth, starting the dangerous habit of thumb-sucking. It is admitted that some are not harmed by it, but that does not prove that it is not dangerous. It simply proves that there is variety in the habit as practiced by different individuals, some making more vigorous suction than others and some making more pressure with the thumb or finger against teeth and palate. Many cases of malocclusion are directly traceable to this cause alone.

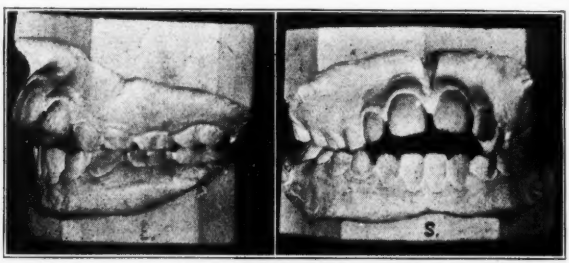

Fig. 2 (Case 2).—Thumb sucking with open bite.

REPORT OF CASES

CASE 1. *Thumb-sucking with protrusion of upper teeth.*—C. C. is still practicing

Fig. 3 (Case 3).—Thumb sucking and lip biting or sucking retrusion of the lower teeth and mandible.

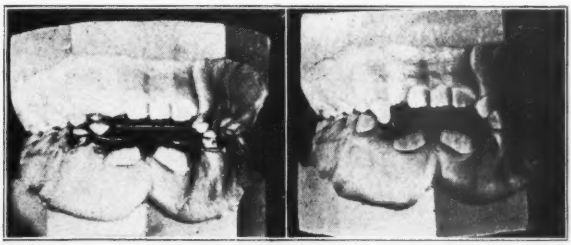

Fig. 4 (Case 4).—Finger sucking and mechanical interference to prevent it.

thumb-sucking at 13 years of age. There is apparently no other cause for deformity shown by the models of the teeth and a facial photograph. This is a Class 1 case or neutroclusion.

CASE 2. *Thumb-sucking with open bite.*—Facial deformity does not necessarily accompany thumb-sucking, and in this case no photograph was taken, but the models show typical malocclusion Class 1 or neutroclusion. The habit apparently was the only cause of malocclusion.

CASE 3. *Thumb-sucking associated with Class II or distoclusion.*—This may have been congenital or may have been caused by the habit. The suction causes narrowing of anterior parts of the dental arches, while the leverage of the thumb tends to carry the lower arch and mandible into a retruded position. The facial photograph shows a tendency to lip biting or sucking in the absence of the thumb.

CASE 4. *Sucking first finger apparently only cause of malocclusion.*—This is a Class 1 or neutroclusion, although when the finger was not in the mouth, the tongue occupied the space made by the finger. Mechanical interference for the finger and tongue is shown on duplicate models.

CASE 5. *Two fingers sucked, tongue held down.*—The tongue displacement and abnormal habit caused narrowness of the upper dental arch and overly wide lower with "crossed bite" (Class 1 or neutroclusion). Facial photographs and the radiogram shows the habit, while models show resulting malocclusion. The tongue occupied the position shown in the radiogram below the plane of occlusion even when the fingers were not in the mouth. The radiogram of the tongue and fingers was obtained by first coating them with bismuth paste, so that their outline might show through the jaws and teeth. The lower part of the tongue may be seen below the mandible. Contrast this tongue position

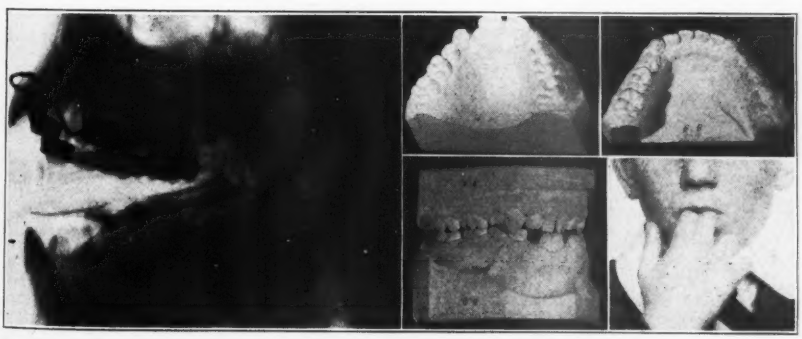

Fig. 5 (Case 5).—Tongue depression resulting from and accompanying finger sucking.

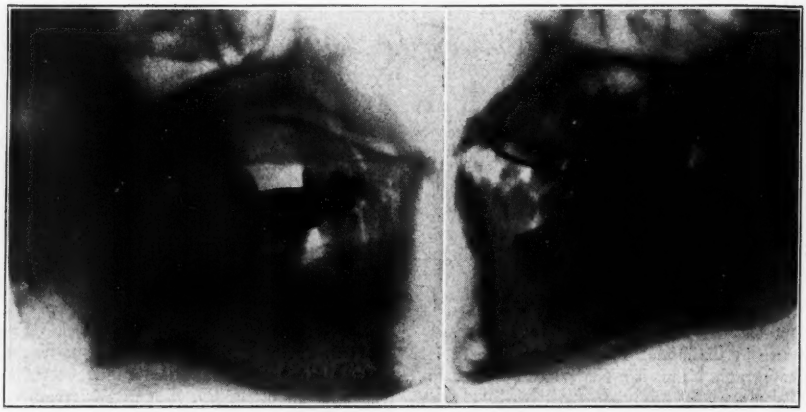

Fig. 6.—Left: Normal tongue position (Case 5). Right: Tongue depression (Case 6).

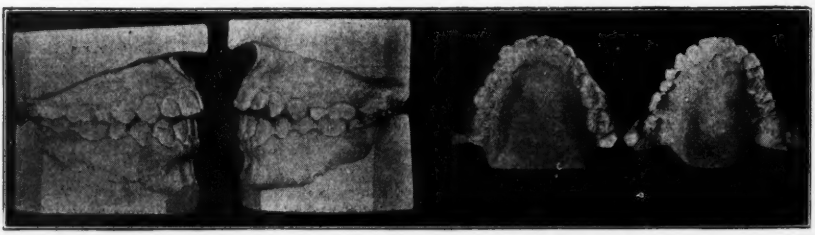

Fig. 7 (Case 6).—Tongue depression.

Fig. 8 (Case 7).—Class I or neutroclusion mouth breathing.

Fig. 9 (Case 8).—Class II or distoclusion mouth breathing.

Fig. 10 (Case 8).—Models from patient shown in Figure 9.

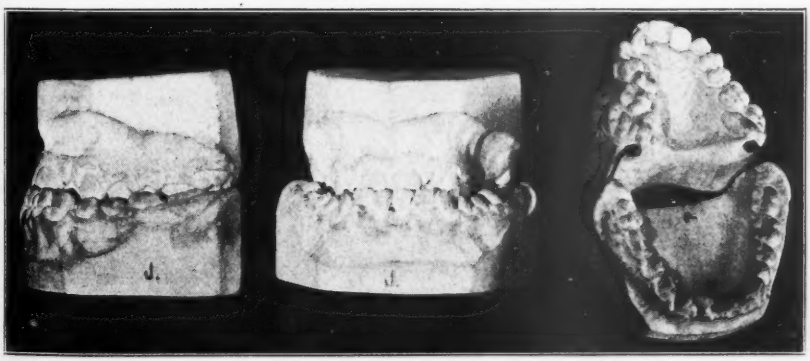

Fig. 11 (Case 9).—Class III or mesioclusion mouth breathing.

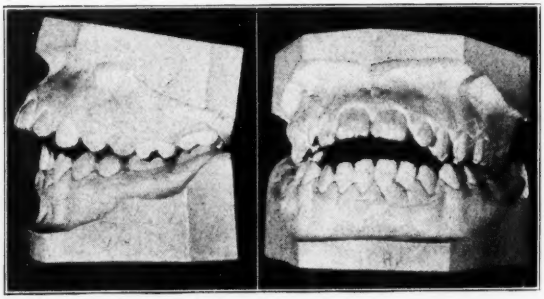

Fig. 12 (Case 10).—Mouth breathing followed later by the habit of holding the tongue between the upper and lower incisors.

with a normal one shown in another radiogram. In this, the tongue lies well up against the palate and but little of it shows below the mandible.

CASE 6.—*Same kind of malposition of the tongue but more clearly shown.*—For this, I am indebted to H. W. McClain, who patiently kindly consented to help me in the experimental radiography of the tongue. Note the abnormal position of the tongue surface relative to the upper teeth and palate and the extent of tongue muscle showing below the mandible. This tongue position may of course result from causes other than finger sucking, mouth breathing for example.

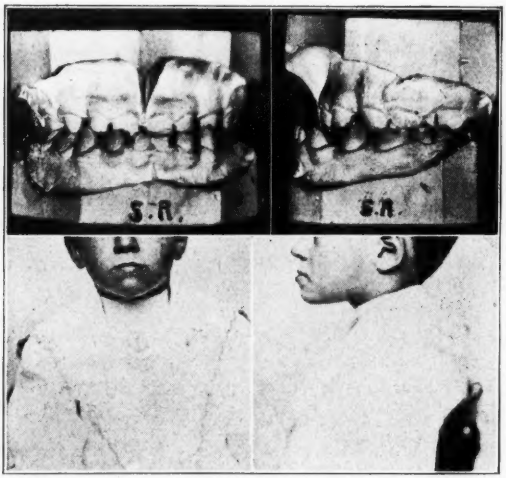

Fig. 13 (Case 11).—Sucking tongue with pressure against lower incisors.

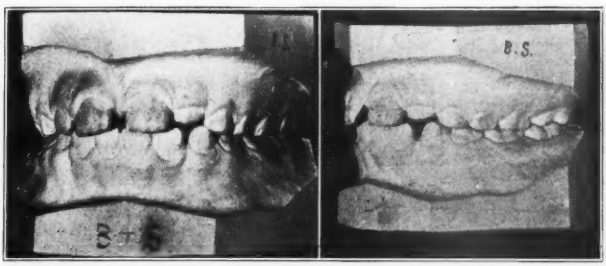

Fig. 14 (Case 12).—Sucking tongue with pressure against upper incisors.

Mouth-breathing may be associated with any form of malocclusion as shown by the three cases which follow, and I think it possible that the position taken by the tongue during mouth-breathing may be an important factor in determining the form of malocclusion accompanying it. Mathew Cryer, many years ago, stated that the narrow upper dental arches in mouth-breathing cases were probably largely due to misplacement of the tongue with consequent failure of its arch-developing function, the tongue being held in the floor of the mouth instead of against the palate. Wallace attributed them to lack of tongue pressure, but explained this deficiency as being due to an undersized tongue, whose size was caused by its insufficient use in mastication. It probably is true that some tongues are undersized and underfunctioned, but normal sized ones may take on a variety of shapes and habits.

CASE 7. *Class I or neutroclusion mouth-breathing with abnormal lip functions and probably lack of vigor in mastication.*

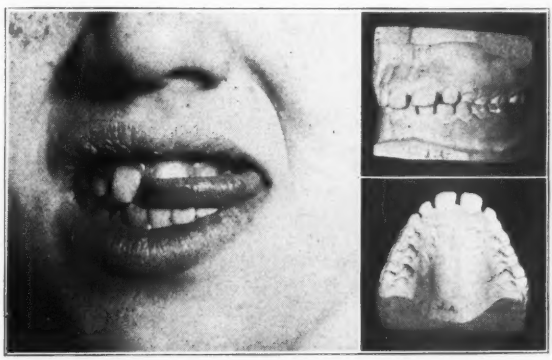

Fig. 15 (Case 13).—Whorling tongue about the upper teeth on the left side, moving them lingually into a crossed bite.

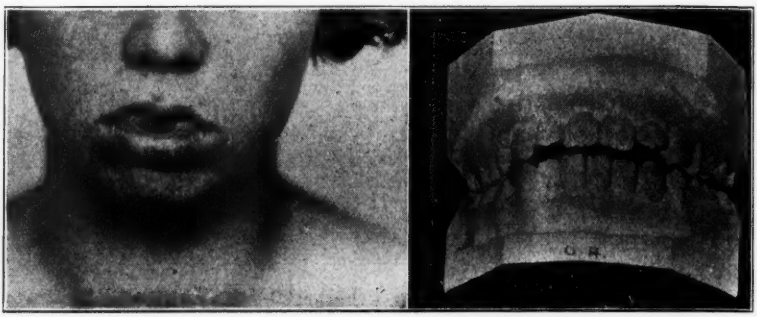

Fig. 16 (Case 14).—Folding back the tip of the tongue and holding it doubled between the upper and lower incisors.

CASE 8. *Class II or distoclusion mouth-breathing associated with tongue spreading over lower bicuspids and molars.*

CASE 9. *Class III or mesioclusion mouth-breathing, associated with a tongue held low in the mandible.* Mastication is almost impossible because of the malocclusion.

CASE 10. *Mouth breathing followed by habit of holding tongue between upper and lower incisors.* Lack of the masticating function due to defective first permanent molars may have contributed to open bite.

The next four cases show a variety of tongue habits in normal breathers.

CASE 11. *Sucking tongue with pressure against lower incisors.* Apparently this was the only cause of malocclusion. Molar anchorage was not sufficient to retract incisors till the habit was broken by lingual bar interference with tongue.

CASE 12. *Sucking tongue with pressure against upper incisors.* The habit may have resulted from the presence of space between the central incisors but was enlarging it and moving all the incisors labially.

CASE 13. *Whorling tongue about upper teeth on left side moving them lingually into crossed bite.* There seems to be evidence also of abnormal pressure moving the incisors labially.

CASE 14. *Folding back tip of tongue and holding it doubled between upper and lower incisors.* Possibly this is a secondary habit following early finger or thumb sucking.

CASE 15. *Effect of cheek sucking.* (Courtesy of Dr. Willett.)

Abnormal lip functions or habits most commonly observed consist of biting or sucking the lower lip, sometimes after other habits, as suggested in Case 3, or of a short or underfunctioning upper lip and a long or overfunctioning lower so often associated with protruding upper incisors, as in Case 16.

CASE 16. *Deficient function of upper lip, excessive and wrong function of lower lip.* The second photographs show the failure and harm of undirected effort by the patient and the impossibility of correcting the lips before malocclusion has been corrected. To avoid such chin distortion, the chin should be held firmly between thumb and finger while the lips are being exercised. A mirror should be used in explaining any exercises; also, in the practice of them.

There is not time for detailed discussion of corrective procedures but, in addition to the usual orthodontic treatment, it is advisable to give the patient constructive counter exercises or habits rather than just to insist that the abnormal function or habit be changed. It is not advisable to encourage increased functional efforts while the patient is still handicapped by malocclusion. The patient might become discouraged before it was possible to accomplish anything. Unless properly

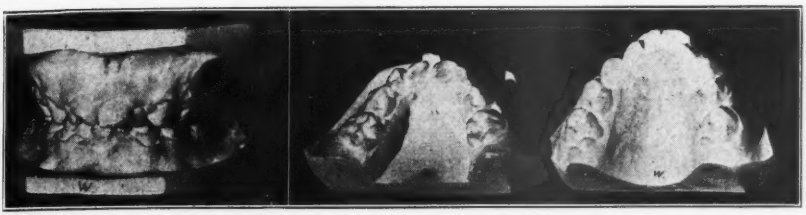

Fig. 17 (Case 15). — Cheek sucking.

directed, mistakes similar to that shown in Case 16 will be made by patients even after orthodontic treatment has removed the chief obstacle. Exercises at regular times are better than continual efforts, and just before meals have some advantages. The parents or some other responsible person is then at hand to direct the child, and normal function is more likely to follow during the meal as a result of the limbering up exercises and the thought of normal use suggested thereby.

Of course, mechanical interference is also often necessary for the sucking habits; and bars placed far enough from teeth and palate to prevent suction have proved most efficient in my practice. Such interference may be combined with the orthodontic appliance, as in the "ligature jack" or telescoping bar and tube, shown with Case 4. Depression of the tongue is a most difficult thing to correct, but the sucking of small pieces of hard candy against the palate with the middle of the tongue, not the tip, has been found helpful, as is also the suggestion to learn to swallow with the tongue against the palate. The cases here shown are but a sample of the great variety of ways in which abnormal function and habit may manifest themselves in association with malocclusion. This is a subject which offers opportunity for interesting and valuable study, and to those wishing more suggestions regarding corrective muscle training, the writings of Alfred P. Rogers are recommended.

Fig. 18 (Case 16).—Deficient function of the upper lip; excessive and wrong function of the lower lip.

GENERAL ANESTHESIA IN THE PRACTICE OF EXODONTIA*

By J. P. HENAHAN, D.D.S., Cleveland, Ohio

THE problem of anesthesia in dental practice is the subject of constantly increasing discussion. It is a hopeful sign, indicating that further material progress will be the result.

Dentistry is one of the most important fields for the practice of anesthesia, and, in order that our prestige be preserved, it is necessary that we progress constantly along scientific lines. If this is to be the case, we must give attention to the avoidance of what seems to be a tendency on the part of many to follow the course of least resistance and lean toward the use of local anesthesia to the exclusion of all other forms.

The widespread use of nerve block by the great majority of dentists constitutes one of the most remarkable advancements in the history of dentistry. It represents a complete departure from the established custom of generations of dentists; a most remarkable feature of the change being the comparatively short time required to bring it about. It is the result of concerted effort on the part of the profession at large to put into practical application valuable knowledge which it has recently gained.

During the short time in which it has been so widely and successfully used, nerve block has permitted a wide extension of the entire field of dental activity. This extension has been a boomerang to a certain extent, in that it has clearly indicated to all who are sufficiently able to observe that local anesthesia by itself does not completely fill the requirements of dentistry.

As a field of surgery, dentistry presents great variety, not only in types of operations performed, but also in the types of patients. This fact, with the multiplicity of symptoms, which are the same as are commonly seen in all clinics, indicates clearly that, in any clinic where surgical intervention of any nature is generally practiced, sufficient knowledge and experience in regard to the wide requirements of anesthesia should be had by the diagnostician and operator.

Clinical experience is continually demonstrating that the selection of the anesthetic for any given case may constitute a scientific problem fully as important as the question of whether or not the operation should be performed.

I have recently read the statement that expert ability on the part of the operator in the administration of nerve block in dental operations should be

*Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 26, 1927.

regarded as a reason for the selection of nerve block in preference to other anesthesia. This may be so when all other factors are equal, but, while expertness in any operative service is much to be admired, it does not constitute in itself a basic reason for the selection of the type of anesthesia to be employed.

It is not unreasonable to expect that the dentist holding himself out as a surgeon should be familiar with all forms of anesthesia in general use, and when that is not the case, his field of endeavor remains restricted.

Regardless of the claims of those who state that local anesthesia is all that is necessary, we are forced, in the light of clinical experience, to acknowledge that there is no anesthetic panacea, and to admit also that, when an anesthetic must be administered, it is a mistake to deprive the patient of the one best suited to the case. The administration of an anesthetic is intended not only for the prevention of pain, but also for the prevention of nerve fatigue and brain cell exhaustion or shock. Many of our patients have already developed certain preoperative conditions which are the forerunners of shock and exhaustion.

Cowell[1] says that, in such patients, almost invariably severe tissue trauma, toxemia, hemorrhage or psychic disturbance is seen. He states further that surgical shock is often the result of unsatisfactory anesthesia. In the same paper, he states that, if intervention is at all severe, the anesthetic should be nitrous oxid-oxygen, either by itself or in conjunction with regional anesthesia.

Current literature of recent years, in this country and abroad, presents many statements conveying the same opinions.

Crile[2] says that after thousands of operations, the Inter-Allied Commission unanimously adopted nitrous oxid-oxygen as the safest anesthetic.

In speaking of this form of anesthesia, he states that the medical degree has nothing whatever to do with qualifying one to administer nitrous oxid-oxygen and that it can be successfully administered only by one who will spend an adequate time in intensive study and training.

There is no material difference between general anesthesia with nitrous oxid-oxygen as administered for general surgery and the same type of anesthesia as employed for oral surgery, with the exception that many of the latter cases are of short duration.

If Crile, with his years of experience, believes that a medical degree alone is not enough, but that special and intensive training is the great essential, it is reasonable to apply the same rule to dentists. When we recognize the fact that the administration of general anesthetics is a service involving the utmost responsibility, we acknowledge that experience and ability on the part of the anesthetist often constitute the main factor of safety for the patient; and when this fact is considered, the one who intends to practice anesthesia will not regret the time spent in training.

In the selection of the anesthetic, many factors must be weighed, but first of all comes the welfare of the patient. When all other factors are equal, and the anesthetic preferred by the operator will permit completion of the operation without discomfort or delay, that anesthetic can be chosen; but when the con-

1. Cowell, E. M.: Lancet, 2: 137 (July 26) 1919.

2. Crile, G. W.: Railway Surg. J., November, 1919.

dition of the patient and the symptoms portrayed indicate definitely that another form of anesthesia should be employed, the preferences or the prejudices of the operator should be forgotten and proper measures should be taken to provide proficient service in the employment of the type of anesthesia indicated for the case.

Sometimes, the patient or the patient's friends request or demand a certain form of anesthesia. If all other factors are equal, well and good; otherwise, the anesthetist must remember that these requests do not absolve him from his responsibility for the results.

Because of the peculiar conditions governing the administration of general anesthetics in dental practice, the agents employed should be peculiarly adapted to meet the conditions.

In the great majority of cases, the patient comes to the office for the operation and expects, on its completion, to be in condition to leave. This is an established custom, resulting from years of practice, and has proved to be equally satisfactory to the patient and the dentist.

The anesthetic originally used was nitrous oxid alone. Sometimes, it was mixed with chloroform and called vitalized air; but the experience of recent years has demonstrated the advantages which result when nitrous oxid is mixed with oxygen.

The problem of dentistry pertaining to the extension of the practice of general anesthesia, therefore, does not consist of a search for a new anesthetic agent, but in bringing the profession to a realization of the great benefits which scientific administration of nitrous oxid and oxygen will bring to the patient.

After everything is considered, nitrous oxid-oxygen remains the anesthetic best suited for the dentist. It is thoroughly known, having been used by generations of dentists since the time of Horace Wells, eighty-three years ago. During the last fifteen years, it has been the subject of research to a greater extent than all other anesthetics. The method of its manufacture also has been improved and, in consequence, a much purer product than formerly was available is now supplied.

Nitrous oxid and oxygen is a mild respiratory and cardiac stimulant and, with it, anesthesia can be induced in the average normal patient quietly and rapidly, the average induction period being about fifty-six seconds. A prescribed technic can be employed with good results in all average cases and can be modified to meet the requirements of difficult or refractory patients.

These terms, often used to describe unusual cases, in a fashion, are only relative, because the patient who would be difficult for one anesthetist to handle might only slightly depart from the average when handled by one more experienced.

There are many types of patients, as well as many pathologic conditions, for which the use of general anesthesia is positively indicated.

Young children seldom can be induced to submit to the injection of local anesthesia any more readily than they will to the operation which is contemplated. It is a mistake to force them into submission, as it leaves a lasting dread of dentistry.

Even in the recalcitrant child, nitrous oxid-oxygen anesthesia is easily and quickly induced, requiring less than one minute. Large quantities of oxygen are used in these cases; which leaves the child quiet and saves him from all pain and shock.

The adult patient (usually a man) who shows a tendency toward syncope when any surgical procedure is initiated presents a case for general anesthesia, if psychic shock is to be avoided.

During pregnancy, many women develop symptoms of nervous depression and grow flighty and irritable. Their cases deserve careful consideration and, unless there is an antipathy against it, general anesthesia is most often a humane remedy.

Septicemia is a contraindication for local anesthesia, and where general anesthesia is necessary, nitrous oxid and oxygen should always be chosen because it does not exercise any destructive influence on the elements of the blood or tissues. Neither does it saturate the saliva or mucous secretions during prolonged anesthesia, forming a mixture which, on entering the lungs or stomach, causes postanesthesia complications, such as nausea or inflammatory conditions of the air passages.

The degree of anesthesia produced by nitrous oxid and oxygen is not so profound as that produced by ether or chloroform, because it does not form a chemical combination with the elements of the blood and tissues as they do and, for that reason, it does not produce the pronounced paralytic effect. These two drugs are excluded as agents in routine dental practice because of the additional drawback existing in the long time required for induction and recovery.

Ethyl chlorid and somnoform, although used with success by many dentists, take the patient from consciousness to deep anesthesia in fifteen seconds, almost too fast for any one to observe the attendant phenomena. In addition, there are no pronounced signs or symptoms which can be taken as warning. For this reason, they cannot be used successfully for prolonged anesthesia.

Ethylene, the new anesthetic, is, under certain conditions, very explosive. Its merits otherwise have as yet not been shown to be superior to nitrous oxid and oxygen.

The chief drawback to the employment of nitrous oxid and oxygen lies in the difficulty in learning the technic of administration, and, of course, proficiency depends entirely on experience.

Cyanosis is a characteristic symptom of straight nitrous oxid anesthesia. It is a result of oxygen exclusion and is entirely due to asphyxia. Under straight nitrous oxid, the symptoms of anesthesia and asphyxia develop simultaneously, but the admission of sufficient oxygen quickly clears up this symptom, while the anesthetic condition continues undisturbed.

In appearance, cyanosis is a terrifying symptom. Its meaning during anesthesia is much more serious under some circumstances than it is under others. When seen in connection with the use of chloroform or ether, it means that a poisonous overdose has been given and the patient's general condition is approaching coma.

During nitrous oxid anesthesia, when the patient becomes cyanotic, his behavior is characteristic. He grows restless, owing to enlargement of the brain cortex, while resulting intercranial pressure causes reflex stimulation, resulting in irregular muscular spasm, defined as jactitation. This fact in itself acts as a safety valve in nitrous oxid-oxygen anesthesia, because it is so pronounced and, therefore, operates as a timely warning. Cyanosis is, of course, to be avoided, or at any rate, not tolerated for long, even under nitrous oxid; not

so much because it is dreadful to see, but because other dangerous symptoms of asphyxia are sure to follow.

Asphyxia, of which cyanosis is a symptom, is the source of all danger arising in nitrous oxid anesthesia. It may be present in rare cases without cyanosis.

Nitrous oxid and oxygen anesthesia, carefully induced and maintained, does not noticeably increase blood pressure, but in no case does it decrease it. Patients with moderately high blood pressure, therefore, are safe risks for nitrous oxid and oxygen anesthesia in the dental office, if anesthesia is quietly and slowly induced, and maintained without the evidence of cyanosis.

The same can be said of patients with congenital or acquired heart lesions, wasting diseases, nervous depression and senile decay, and exhaustion due to severe suffering and lack of rest.

In patients who are greatly excited or are bordering on shock, much benefit follows the administration of morphin in combination with atropin. It should be administered thirty minutes previous to the beginning of anesthesia. This is now a routine practice in all hospitals. The morphin produces a quieting effect on the patient and allows him to become resigned and submissive. It conserves energy in the brain cells and prevents or minimizes shock. The atropin operates as a respiratory stimulant and also prevents excessive mucous secretion.

This treatment also is valuable with the refractory patient or the one who tolerates large quantities of anesthetic without resulting narcosis, not only in nitrous oxid cases, but with chloroform or ether as well. In practically all cases, this treatment permits anesthesia to be more easily induced and maintained.

In cases in which swollen lymphatic glands indicate chronic infection, impaired immunity and resistance can be suspected, and any condition taxing the patient's resistance should be prevented if possible. In these cases, the operator assumes a great risk as regards postoperative results, and when these results are bad after local anesthesia has been used, it is often pointed out as the exciting cause.

Any local condition, such as cellulitis, edema, trismus, Vincent's infection, suppurating gingivitis, pyorrhea, extensive inflammatory conditions of the mucous membrane of the mouth, ulcerous conditions and suppurating alveolar abscesses, as well as uncleanliness and neglect, is an indication for the use of general anesthesia and a contraindication for the use of local.

In any of these cases, the introduction of a hypodermic needle might be the medium through which infection is carried deep into the tissues, converting a local or surface infection into one of general character.

Repeated injections of the same field is often a dangerous procedure, because, after the tissues have once been opened, not only is the scheme of conduction anesthesia less practical, but there is also a certain amount of danger of lowering the resistance of the tissues so treated.

There are, of course, some negative features associated with the use of nitrous oxid and oxygen, in addition to the difficulty of learning the technic and, as stated before, the danger born of inexperience. This feature is minimized by care and attention to the details of administration.

We must remember that we have been trained to become scientific men. We have been given at least a theoretical foundation upon which our own individual efforts will build a super-

structure of skill. Anesthesia is one of the most scientific branches of medical science, and at least a goodly proportion of the dental profession should become proficient in its administration.

Every dentist whose practice includes oral surgery to any extent will encounter cases in which general anesthesia will be absolutely necessary. Some of these cases will be hospitalized, and every dentist, under such circumstances, in duty to his profession as well as to his own name, should be familiar with the behavior and condition of his patient under general anesthesia.

It has been my object to present this paper in such a manner that there shall appear to be neither prejudice nor preference regarding any anesthetic agent or method, and to sound a note which may stimulate the dental profession to greater consideration of the wide benefits of general anesthesia under nitrous oxid and oxygen.

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DISCUSSION

E. L. Moravec, Cedar Rapids, Iowa: Dr. Henahan's paper differs materially from the average paper presented. It does not go into the scientific details as to the causes and effects of anesthesia, but is rather a plea for more consistent study on the part of our profession, and the scientific study of anesthesia, especially on the part of members of the Section on Oral Surgery. The anesthetic field as it pertains to oral surgery is probably the most difficult phase of anesthetics. In general surgery, the patients are better prepared and more thorough information is at hand. The patient's face is free from surgical interference; which makes it much easier to handle the case. We find, in the field of oral surgery, confined to the mouth as it is, respiration is interfered with. In hospital work in general surgery, a novice is not allowed to act as an anesthetist nor permitted to give anesthetics; while, in the field of dentistry, it seems that all one requires to call himself an anesthetist is a gas machine, purchased of a salesman who convinces him that all that is necessary is to turn on the gas and set the dials at a specified point. He gets along fairly well in a few ideal cases, then suddenly meets a difficult one, resulting in failure, and loss of confidence in himself and in gas anesthesia; and the machine is put aside, and gas anesthesia is condemned. While we have possibly not yet discovered a perfect anesthetic, we have a number to select from, and it should be left to the anesthetist to make the selection, provided the complete history of the case is familiar to him, and this at all times should be the barometer by which the selection is made. Ethylene as an anesthetic has traveled through the changes, the rises and falls of other new anesthetics or drugs, and I believe eventually will find its level at a point somewhere between nitrous oxid and ether. It is probably a more profound anesthetic than nitrous oxid but has a number of objectionable qualities that nitrous oxid does not have. In my practice, for the past year or more, I have used ethylene as a synergist to nitrous oxid. Cyanosis in anesthesia is not a perfect guide, as the condition of patients varies greatly. It should be tolerated for only a very short period. Respiration is by far the most perfect guide in any anesthesia and one on which we may rely in fluoroscopic work (fractures) almost entirely, since that is done in darkness. The field for block or infiltration anesthesia is an important one. It is contraindicated in many cases; and many times the general practitioner refers patients to the specialist because he wishes a general anesthetic used. We, as specialists, therefore, should strive to perfect our technic in the general anesthetic field. One of the important and interesting phases of anesthesia is the classification as to type of our patients. One should be a very efficient student of human nature and seek to establish confidence and be worthy of it. This constitutes half the battle, especially in the case of children. Another interesting case is that of the expectant mother. For many years, we have been given the impression by physicians, as well as the laity themselves, that this was the dangerous type of patient. Experience has taught us that this is not the case. I believe that a normal healthy patient in this condition is the most nearly ideal patient for anesthesia that we have, during the earlier months of pregnancy. I have given many general anesthetics of nitrous oxid for major

operations to patients even in the eighth month. In several cases the patient continued on through convalescence to confinement, with a practically normal termination. In summing up, we return to the plea not for more anesthetic agents and more anesthetists, but for more training and study in the field of anesthesia, producing more competent and scientific work.

Martin L. DeBats, Detroit, Mich.: Dr. Henahan has stressed the importance of the best known and most adaptable general anesthetic for use in exodontia. When a general anesthetic is required, no other agent equals nitrous oxid-oxygen, and, through its employment, hundreds of thousands of patients are operated on with a minimum risk. It is necessary, however, that one became familiar with and have a thorough basic knowledge of its action and how to apply it. Some operators, in their enthusiasm for a particular method, attempt to make the case fit the anesthetic instead of the more logical course of choosing an anesthetic that fits the case. We must admit that there are a few contraindications which should be considered in the use of nitrous oxid and oxygen. The most important is impairment of the air passages. The rapidity of the action of nitrous oxid-oxygen presents desirable as well as dangerous features; desirable, because it shortens induction and produces a relatively short recovery period. This characteristic of rapid induction may be a source of danger. The signs develop quickly, and while pronounced and most evident, if overlooked, may result in dangerously deep narcosis. When such a condition does occur, the generous employment of oxygen quickly restores a safe level of anesthesia. Cyanosis, while terrifying and undesirable, is not necessarily dangerous. The plethoric type of patient usually is somewhat cyanotic during narcosis. Persistent cyanosis is dangerous, because it leads to asphyxia. Certain types, fortunately relatively uncommon, show little or no color change during anesthesia. These individuals usually require an amazing quantity of oxygen for safe anesthesia. In such a case, the color signs are naturally undependable. While nitrous oxid-oxygen is a mild cardiac and respiratory stimulant, we should, nevertheless, satisfy ourselves that the patient is a safe subject for anesthesia. Inquiry into the general physical condition, and, in some cases, laboratory reports, will reassure one or point to the desirability of some other method. Slow induction is most desirable, and should be accomplished with the judicious use of oxygen. Some operators advocate the so-called "back in method." By this, we mean starting the induction with a high percentage of oxygen, gradually reducing it and increasing the anesthetic until the proper plane is reached. This method is especially desirable with children. Some writers classify normal anesthetic symptoms, according to their importance, in the following manner: (1) regularity and type of breathing; (2) pupillary reflex; (3) muscular tone, and (4) color change. Rhythmic breathing is the most important. Premedication is always advisable when the patient is excitable or unruly. Alcoholics, drug addicts and athletes are in this class. The majority of exodontia operations are performed in the dental office, and nitrous oxid-oxygen, because of its easy induction and short recovery period, is far superior to ether, chloroform or ethylene-oxygen. These anesthetics are more in keeping with hospital surgery. Ethelyene-oxygen is an excellent addition to our list of anesthetics, and, in some ways, is an improvement over nitrous oxid-oxygen. The explosive nature of the agent, the longer recovery period required and the frequent occurrence of postoperative nausea make it undesirable. It is pleasing to note that Dr. Henahan makes favorable mention of local and block anesthesia. The wide use of nerve blocking, particularly, marks an era of progress in dentistry. Thorough competence in nerve blocking should not predispose to its use when a general anesthetic is indicated. It is necessary to be prepared to use either method with equal confidence, so that we may choose the anesthetic which the case requires.

PERIODIC TREATMENT OF MALOCCLUSION*

By R. C. WILLETT, D.M.D., Peoria, Illinois

IN a practical consideration of periodic treatment of malocclusion, certain established facts relative to normal growth and development must be considered, as a basis for determining when corrective treatment of deficiency in the development of the jaws, and malocclusion of the teeth, should be instituted.

Three general periods are recognized in the development of the skull. The first period, in which the skull grows rapidly, is from birth to about the age of 7 years. The second period, of slow growth, is from the seventh year to the age of 10 or 12. The third, in which the rate of growth again increases, extends from the tenth or twelfth year to about the nineteenth in the female, and to a little later period in the male.

During early infancy, all parts of the skull grow rapidly. In the first six months of life, the cranial cavity of a child increases from about 400 to 700 c.c. From that time on, the increase of cranial capacity is less rapid, showing a gain of about 250 c.c. between the ages of 6 and 18 months. During this period, the facial skeleton grows even more rapidly than the cranium, so that the ratio of 1:8, between the two at birth, is reduced to that of 1:6, in the course of the second year. This rapid growth of the face is due partly to the increase in the size of the orbits, which accomplish over half of their postnatal growth in the first two years of life, and partly to expansion of the maxilla.

The facial skeleton continues to grow more rapidly than the cranium, and at the age of 5 years, the relation between the two has become that of 1:5. Most of the growth of the facial skeleton has been in the lower part of the face owing to the lateral expansion of the hard palate, and to the development of the maxillary sinuses.

By the end of the seventh year, many parts of the skull, such as the body of the sphenoid bone, the cribriform plate of the ethmoid and the petrous portion of the temporal bone, have attained their full size, while other parts, such as the orbits, have almost reached adult dimensions.

It is evident from the foregoing, and from a review of the growth and development of other parts of the body, including the observation of the process of dentition, which we have not as yet considered, that there are well defined periodic stages of growth that, while progressive at all times in the normal, are governed by nutrition, function and individual characteristics.

In following the course of normal dentition, we find that the eruption is periodic, the teeth erupting by twos and fours until the twenty deciduous teeth are in full function. Then ensues a period of possibly two years, during which time no change occurs, with the

*Read before the Midwinter Clinic of the Chicago Dental Society, Jan. 27, 1927.

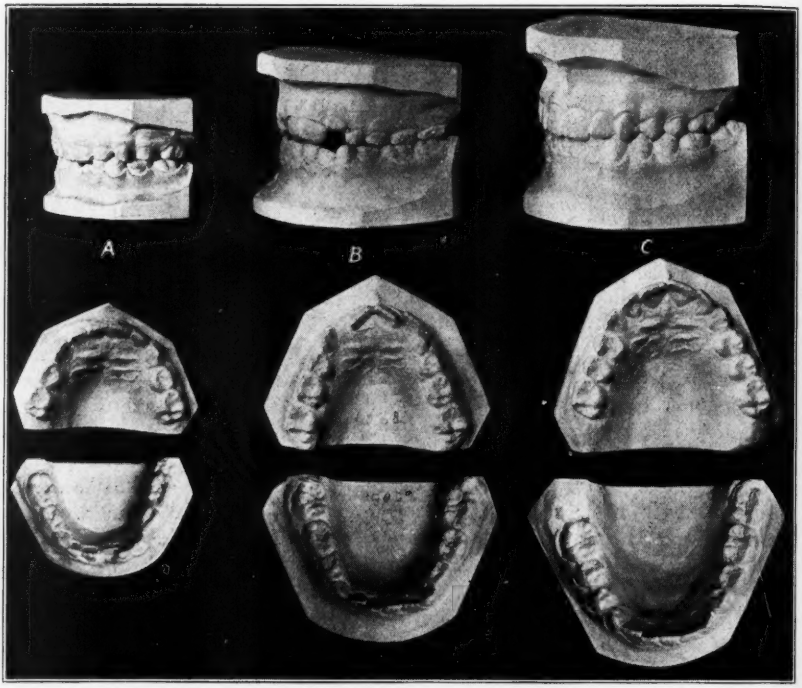

Fig. 1 (Case 1).—Unilateral distoclusion. Periodic treatment between ages of 6 and 11 years

exception of a more forward and vertical growth of the jaws, the occurrence of spaces between the anterior deciduous teeth, previous to the eruption of the first permanent molars, and the loss of the deciduous central incisors.

The process of dentition continues to be periodic in its every phase, until permanent dentition is completed, except in the eruption of the third molars. Here, we find a lapse of some years. No development is in evidence other than a sufficient lengthening of the jaws to accommodate the eruption of these teeth.

The entire scheme of physiologic development is periodic. Is it not consistent, then, that our aids applied for natural growth and development should as accurately follow the normal course of progress in growth and development as our knowledge will permit, rather than be withheld until we are confronted by gross evidence of malformation of the jaws and malocclusion of the teeth?

As dentists, our attention has been focused on malocclusion of the teeth rather than on the deficiency in development which precedes practically every recognized type of malocclusion. Such deficiency may exist at an early age, without apparent malocclusion, malposition of individual teeth, facial de-

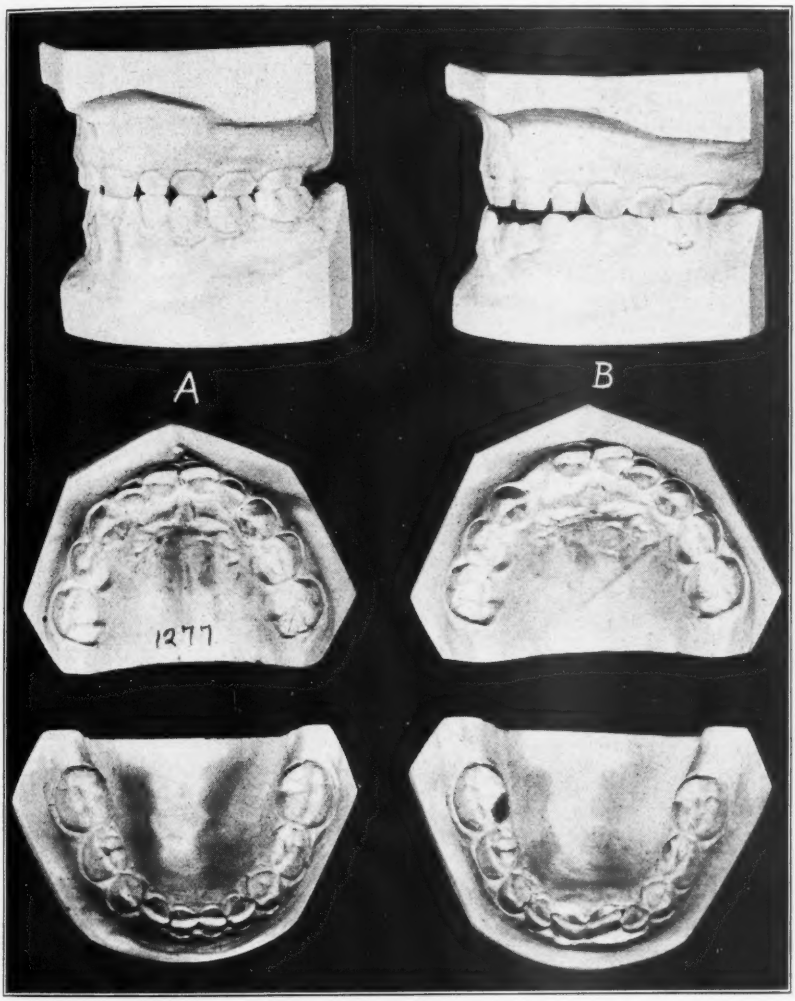

Fig. 2 (Case 2).—Cross-bite. First treatment period age 4 years 7 months.

formity or malfunction. Therefore, our attention should be centered first of all on the state of development of the dental arches for the purpose of gaining a working knowledge of how such a state of development may affect their normality of form, relation one to another and functional efficiency.

Primarily, the orthodontic problem is not a tooth problem, but a problem of

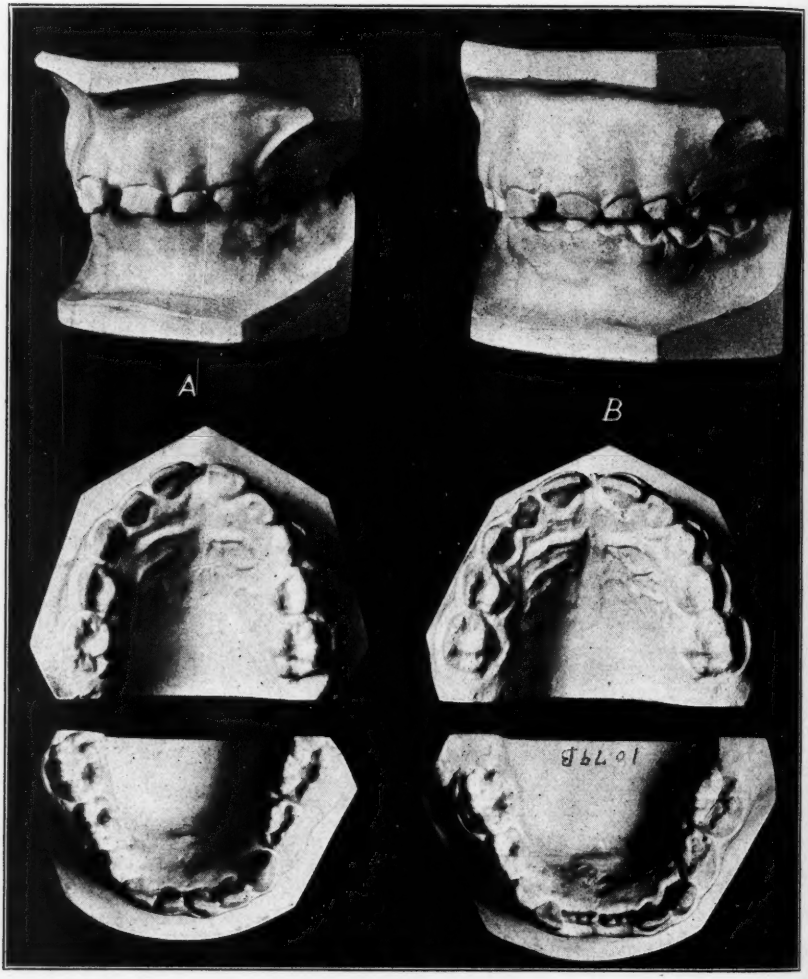

Fig. 3 (Case 3).—Bilateral distoclusion. First treatment period age 4 years and 10 months.

development. Malocclusion is undoubtedly the result of a functional disturbance in development of the bone and its associated tissues, the basic etiologic factor of which may be intrinsic or extrinsic, or one which combines both of these qualities.

The two factors, intrinsic and extrinsic, determine the initiation, course and outcome of the development of body structures, and the influence of the two on skeletal growth involves two distinct periods.

1. The intrinsic factors are largely

Fig. 4 (Case 4).—Collapse of dental arches due to cheek sucking. First treatment period age 4 years and 6 months.

the guiding and determining ones of development in first formations, prior to establishment of function.

2. The extrinsic factors involve function, promoting further growth and the development and maintenance of structural form necessary to the complete normal structure.

The developing structure is not the cause of function, nor is the future function of the part responsible for the structure, but each factor is dependent upon the other, and both must evolve together. In short, they are inseparable, and anything which modifies or changes one, affects the other and results in its modification.

In what way does this biologic fact concern our problem? It is the very basis for periodic treatment of malocclusion, for it establishes a working hypothesis; namely, that stimulation, applied in a retarded growth and development of the mandible and the maxilla, will be favorably reflected to the associated structures of the cranium and facial skeleton, which reach their maximum growth before the seventh year of the child's life.

This hypothesis is substantiated by the research and experiments of Baker,[1] to the conclusion that interference with jaw function will affect the development of cranial structures.

Periodic treatment of malocclusion is not to be understood as the whimsical setting or removal of appliances, nor an intermittent attention of any description, but as the scientific application of preventive or active treatment that may be indicated by any particular state of development, whether such treatment is for nutrition, and the strengthening of certain groups of muscles by exercise, or consists of the direct application to the teeth of devices for mechanical stimulation of bone growth.

Periodic treatment, in its application to the different stages of dentition, may be considered according to the following plan, although, because of the variation of normality in individuals, the ages mentioned are, of necessity, only averages.

1. From birth to 3 years. During this period, all of the deciduous teeth erupt. Evidence of deficiency in arch formation may be detected, and malrelation of the dental arches may exist. The deciduous maxillary incisors may erupt lingually to normal. Treatment during this period is generally nutritional and preventive in character; a guarding against the forming or practice of habits productive of malocclusion, such as thumb sucking, lip biting, tongue sucking and wrong habits of posture, while asleep or awake. Certain cases occur that may, at this time, be benefited through the use of appliances, though in a very limited way.

2. From 3 to 6 years. During this period, deficiency of development of the dental arches becomes more noticeable, particularly any deficiency in width.

Corrective treatment during this period may be the same as in the preceding stage, though deviations from normal in arch formation will demand more radical means of correction, the very last resort in such corrective treatment being the mechanical stimulation of bone growth through the use of orthodontic appliances, and this only as an adjunct to the general correction of deficiencies of growth.

Howard says with emphasis: "A child has a body, as well as a mouth, and the growth and development of both must necessarily arise from the same general influence. This influence, of course, may be ascribed to all of the metabolic activities of the entire physical system."

At the close of this period—about the sixth year—certain bones closely associated with the mandible and the maxilla have attained almost adult pro-

1. Baker, L. W.: Influence of Occlusion on the Development of the Bones of the Skull, Internat. J. Orthodontia, 7: 259, 1921.

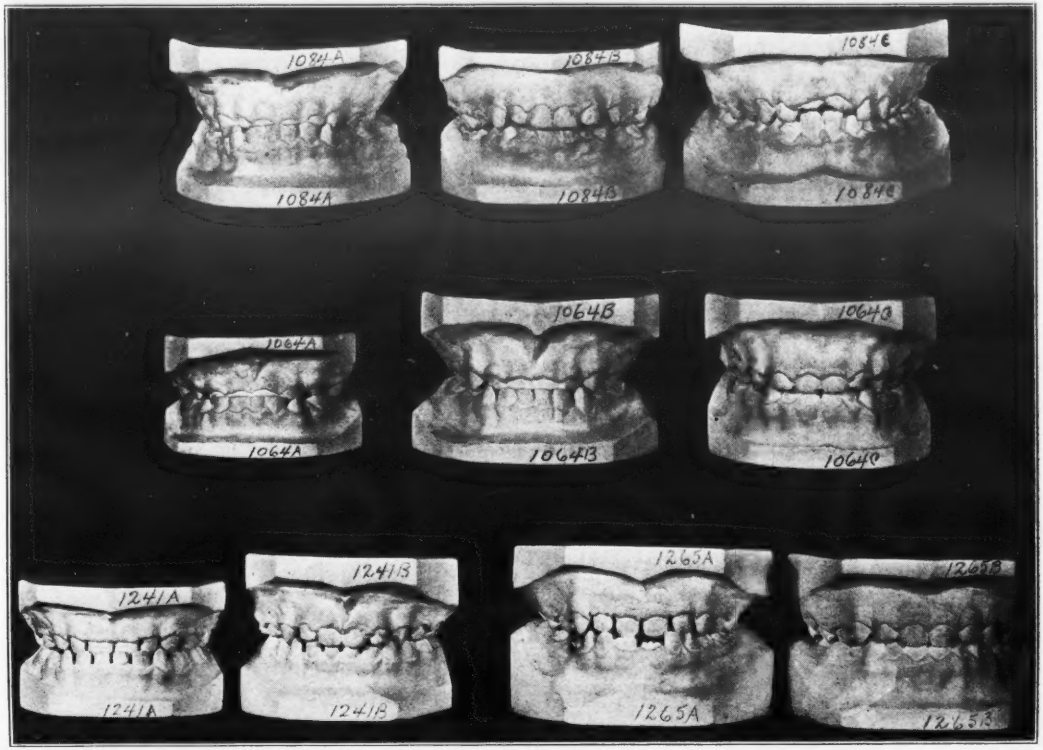

Fig. 5.—Result of treatment in a series of four cases in which the maxillary deciduous incisors locked lingually to normal. The ages of the patients were from 3 to 5 years.

portions in growth, these being the sphenoid, the cribriform plate of the ethmoid and the petrous portion of the temporal bone, all without doubt, dependent on the full functioning of associated parts for attainment of normal proportions in their finished growth. This dependency makes clear the necessity of a normal development of the dental arches, and a full functioning of the muscles of mastication, the jaws and the teeth.

Closely associated with the form of the dental arches is that of the nasal cavity, and the sinuses of the upper respiratory tract, although obstructions to respiration may be the direct cause of dental arch malformation.

3. From 6 to 8 years. With the beginning of this period, the first permanent molars should erupt. The deciduous incisors are eliminated in consecutive order, by twos, beginning with the mandibular central incisors, closely followed by the eruption of the permanent incisors.

An early deficiency of arch development may have left a marked effect on the position of the erupting incisors, and, therefore, the time before the loss of the deciduous molars is an opportune one in which to apply further corrective treatment that shall advance the normality of the positions of the incisors in the arch. It is important that the arch relation be restored at this time if it should happen to be mesial or distal to normal.

4. From 8 to 12 years. Within this period, and during the latter part of the preceding one, there are times when active treatment is not advisable. The roots of the deciduous molars have become absorbed, until they are not serviceable for anchorage. It is well, at this time, to supervise the removal of the deciduous molars, and to correct the tendency toward malposition of the erupting bicuspids. Attention to the position of the cuspid teeth and the second molars should terminate the treatment during the years between 10 and 12.

Periodic treatment, its applied principles and its advantages can best be illustrated by the presentation of cases so treated. The cases selected are of distinct types, in which malocclusion and deficient development are not associated with caries of the deciduous teeth nor their premature loss.

REPORT OF CASES

CASE 1.—*History.*—A girl, aged 6 years and 5 months, was undernourished, even anemic, and, for a child of her age, was below the standard in weight as compared to height. She was subject to bronchitis, and adenoids obstructed nasal respiration. Her tonsils were hypertrophied and infected. The oral conditions are shown in Figure 1*A*. There was a deficiency in development of the dental arches, and the first permanent molars were not erupted. There were no spaces between the deciduous incisor teeth; which, plainly enough, meant lack of space for the eruption of the permanent incisors. The width of the maxillary arch, measured from the cervix of the second deciduous molars on the lingual side was 27 mm.

The figure shows that the mandibular left deciduous central incisor had been extracted, and that the corresponding permanent incisor was erupting lingually to normal alinement.

First Treatment Period.—The mandibular arch was expanded to the extent of establishing sufficient width for the eruption of the permanent central and lateral incisors. This period of treatment included two months.

Second Treatment Period.—After a rest of two months, treatment was resumed by means of mechanical stimulation applied to the mandibular arch for a period of five months. The object in view was to develop the mandibular arch more fully, and, through the force of occlusion, to stimulate the growth of the maxillary arch. The parents were by this time convinced of the necessity of general

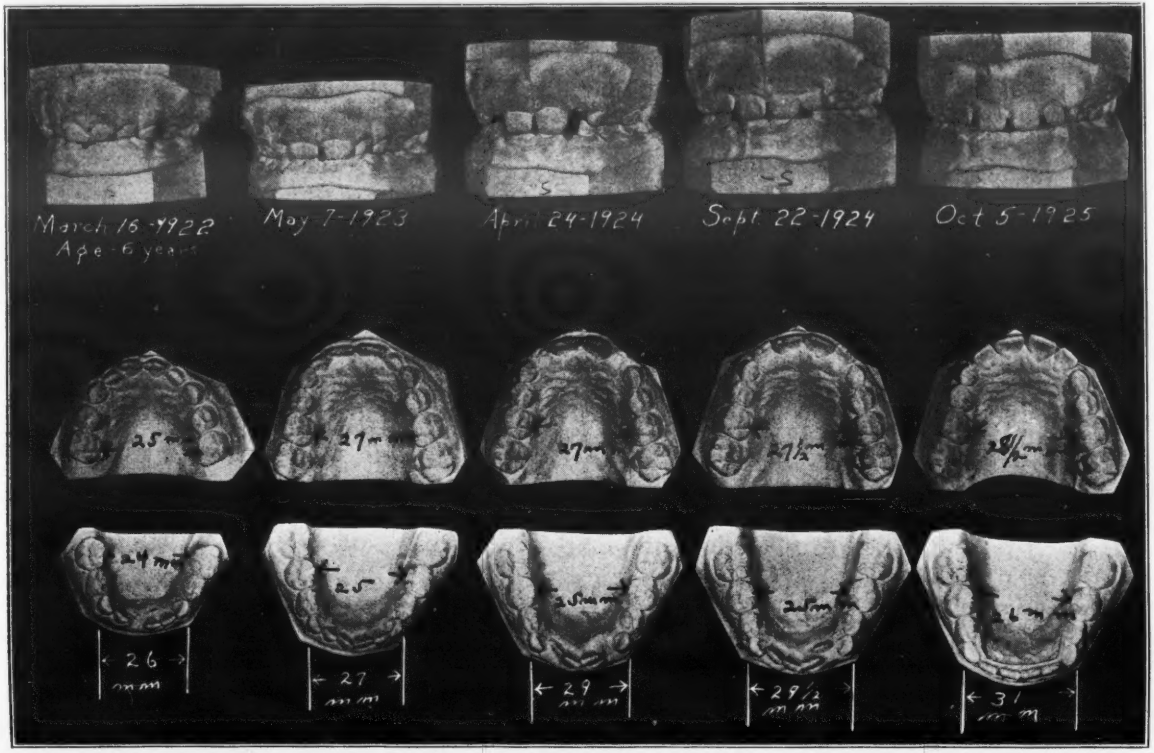

Fig. 6.—Series of casts of a case in which the progress of growth was recorded before beginning orthodontic treatment.

constitutional treatment, and, acting on our advice, had the tonsils and adenoids removed. A change of climate was made during the summer months, and, on entering school, the child was enrolled in the open-window room. This phase of the treatment brought about a general improvement in health and physical vigor.

Third Treatment Period.—Active orthodontic treatment was not resumed until two years later, after the first permanent molars and the mandibular incisors were fully erupted. The maxillary incisors, though not fully erupted, gave ample evidence of an inclination to malposition, as shown in Figure 1*B*. As a result of previous treatment, little change had occurred in the width of the maxillary arch. Possibly this was due to the fact that the removal of all obstructions to full nasal respiration (the adenoids and tonsils) had been delayed in the beginning of treatment. This, of course, should have been the first step in the preparation of the patient. Attention was now directed to the treatment of the maxillary arch for a period of five months.

Fourth Treatment Period.—A year later, the cuspid teeth erupted, and an appliance was placed to guide them to their proper positions in the arch. This last service of active treatment, covering a period of three months, terminated in a development of the dental arches, and occlusion of the teeth as shown in Figure 1*C*.

While the case was under treatment and observation for upward of five years, the actual time of active treatment, and of the use of appliances on the teeth, did not exceed fifteen months, and at no time were appliances used for the purpose of postmaintenance.

In the treatment of this case, the normal individual characteristics of growth and development were permitted to go on, and the deviations from normal arch form and occlusion were corrected during the second period of rapid growth in childhood. The occlusion of the teeth and the arch form are now in keeping with the outward physical appearance of the patient.

A series of cases will now be presented, to which, during their various stages of growth and development, periodic treatment will be applied that will meet and correct deviations from normality as they occur, and at the specific time when those variations most readily yield to corrective treatment.

CASE 2. (Fig. 2*A*.)—A girl aged 4 years and 7 months, of good general physical development and health, presented a maxillary arch deficient in width, this deficiency resulting in a cross-bite, causing malposition of the mandible to the left side on closure of the jaws. The treatment, during the first period, was for general expansion of the maxillary arch. Figure 2*B* shows the result of three months' treatment. The treatment during the second period will be for a general expansion of both arches, which will be completed before the eruption of the first permanent molars.

CASE 3. (Fig. 3*A*.)—A girl, aged 4 years and 10 months, had adenoids slightly obstructing nasal respiration, and hypertrophied tonsils, but the advisability of operation was questionable, as the general health of the child was good. The teeth were free from caries and perfect in form. The deciduous teeth erupted late, beginning at 11 months of age, and she was ill much of the time during the eruption of these teeth. The thumb-sucking habit was not associated with the oral deformity, although appearances were suggestive. The arch relation was bilateral-distal. The maxillary second deciduous molars locked lingually to normal, the width of the maxillary arch in that region being 23 mm.

The result of the treatment during the first period is shown in Figure 3*B*. A general expansion of the maxillary arch was secured, the width in the second deciduous molar region being increased to 28 mm. The arch relation was corrected. At the conclusion of the treatment, the adenoids and the tonsils were removed.

Periodic treatment of this case will be resumed when the first permanent molars erupt and are in occlusion.

CASE 4. (Fig. 4*A*.)—A boy, aged 4½ years, was a well nourished child, although the dental arches were deficient in development, owing to the lack of use of the muscles of mastication. He sucked his food rather than chewed it. The width of the maxillary arch in the deciduous molar region was 22 mm. Corrective treatment was applied until the width of the mandibular and the maxillary arches was increased 6.5 mm., as

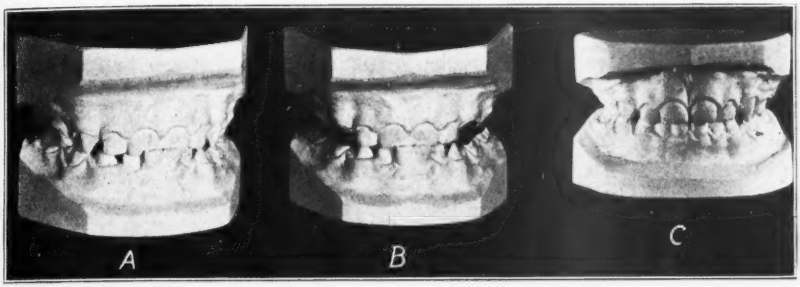

Fig. 7—Result of ten days' treatment at the age of 6 years and 4 months.

shown in Figure 4*B*. It will be noticed that the first permanent molars followed the lateral development, and are erupting in correct alinement.

It is regretted that later models are not available with which to show the further progress of treatment in this case.

In Figure 5 is shown a series of four cases in which the maxillary deciduous incisors locked lingually to normal occlusion, and in two of them the arch relation offers more than a suspicion of being bilaterally-mesially to normal. The ages of these patients range from 3 to 5 years. In three of them, the active treatment did not exceed a period of four weeks in securing the results here shown.

No doubt, most of these cases will require a later period of treatment, and that fact has been positively impressed on the minds of the parents.

I do not wish the impression to go out that every deviation from normal in the form of the deciduous arch demands appliance treatment. Such is not the case. The correction of habits, the judicious extraction of deciduous teeth, muscle training, normal respiration, etc., will bring about normality in certain cases. Our great need is a clearer knowledge of the etiologic factors, general or local, as they may affect growth of the jaws and dentition; such knowledge of these factors as would enable us to make a more scientific, differential diagnosis of the cases that we contemplate treating.

Figure 6 illustrates a case from the practice of Dr. Lourie. On first examination, a noticeable deficiency in the width of the dental arches was found. As the child had robust health, despite the apparent deficiency in arch development, it was considered best to keep the case under periodic observation. An increase in width of the mandibular arch was soon noticed, and recorded. From time to time, a study model was made, as shown. It was not until the patient reached the age of 8 years that it was considered necessary to resort to the use of appliances for the further correction of the occlusion.

There seems to be a wide range of opinion among orthodontists as to just what the orthodontist is warranted in undertaking in the treatment of retarded development of the deciduous arch, and the malocclusion of the teeth, at an early age in a child's life.

The following are a few of the objections to such treatment:

1. Some cases of admitted malocclusion in early life have apparently been self-corrected later.

This statement that "some have" is

undoubtedly true; but when malocclusion is usually found in eighteen or nineteen out of twenty individuals, by the time that the twenty-eight permanent teeth have erupted, it would seem that if only 10 per cent are in normal occlusion, an error is made in assuming that it is safe to "take a chance" on self-correction. Is it not evident that the most incipient deficiencies of arch development should be most carefully considered, rather than that the odds of one to ten be risked that "everything will come out all right?" If the ratio were fifty-fifty, such a view would be more consistent.

2. An orthodontist of years of experience makes a statement that seems to express the opinion of many. He says: "I am doubtful of the ability of any physically handicapped individual to ever resume dental development." He states as his experience that, in cases of marked arrested development of the deciduous arch, though treatment would bring about a condition that should be normal at the time of eruption of the first permanent molars, such cases do not seem to be able to go on, and, without further treatment, show development that should be evident at the age of 7 or 8 years. He also states that malocclusion is not less severe than is usually found in cases coming in at that age for the first time.

Before considering this argument as a sound basis of reason for the postponement of orthodontic treatment, a comparison of individual cases treated, with those not treated, and a careful comparison of case histories might reveal a few worth while facts.

3. Another quoted reason for postponing treatment is: "The unforeseen trend of development of malocclusion cannot be determined until permanent teeth have erupted, and with the full scope of the deformity in view, more definite information can be given relative to the treatment of the case; also, the parent capable of sustained orthodontic interest, over a long period of years, is not common. You may explain ever so carefully at the start that you expect the treatment to be periodic, but when the period of the second or third treatment arrives, they have forgotten all about the explanation at the beginning."

Complete case records, and a definite written explanation elastic enough to contain about all that might occur in the course of the unfolding of inherent qualities of development, would be an aid in impressing on the minds of the parents that there is nothing definite as to time requirements in treatment of a case.

Their attention must be focused on the correction of habits, mouth hygiene, muscle exercises; they must be made to understand that appointments are made for a definite service in the course of treatment, and, in fact, every phase of treatment that depends on the parent's initiative should be incorporated in such written explanation.

4. Another reason given is that "appliances are not tolerated by a child patient under 6 years of age, and the difficulty of management is a handicap."

This is a pure fallacy, in its first statement, and its second statement relates only to the operator's ability and his tactfulness.

It is not my intention to enter into the technicalities of treatment, but reference will be made, and illustrations given, showing a simple, secure and easily applied posterior anchorage.

Cast overlays can be made (Fig.

7A) that will hold the appliance secure, whether the operator wishes to use lingual or labial attachments, or to combine the two. Such anchorages have this advantage over the usual bands: no separation of the teeth is necessary. There is nothing crowded below the free margin of the gum to cause irritation, and, should the anchorage become free of cement, it can only come off, doing no harm and in no way injuring the soft tissues.

Its use eliminates the fitting of anything on the teeth in the course of preparation. The taking of an accurate impression is all that is necessary. The cementing of overlays is far less difficult than the cementing of bands.

The illustration shows the case of a little girl, 2 years and 4 months of age, entered for treatment a few weeks ago. It will be noticed (Fig. *7B*) that the overlays on the cuspids and deciduous molars are made sufficiently heavy on the occlusal surface to open the bite. Buccal attachments were made in completing the treatment appliances. Figure *7C* shows the result of this first period of treatment, which took just ten days.

"Criticism is the life of science. It is the safeguard of progress." Criticism of my theory, the principles applied or the results obtained through periodic treatment of malocclusion as presented is welcomed.

ENGINEERING IN ORTHODONTIC DIAGNOSIS*

By FREDERICK LESTER STANTON, D.D.S., New York City

DENTISTRY has been defined as a blend of engineering and biology. Gies, as head of the investigating committee on Dental Educational Research for the Carnegie Foundation, has stated that the greatest need of dentistry today is a more thorough training in engineering. This attitude of Gies will arouse the interest of the dental profession to a more sympathetic attitude toward the dentists who have been cooperating with engineers to solve some of the dental problems that naturally fall in the field of engineering.

*Read before the Section on Orthodontia at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

Let us take Gies' definition of dentistry and apply it to the specialty of orthodontics. Orthodontia will be divided into engineering and biology. For the term engineering, we may substitute mechanics. Unfortunately, both terms (engineering and mechanics) convey confused meanings. A highly trained technical man practicing the profession of an engineer is often confounded with a locomotive engineer. Even our janitors, in the better grade of New York apartments, are self-styled engineers.

Mechanics has for some time been taboo in polite dental circles. Anyone advocating the more thorough study of mechanics in orthodontia has been frowned on by his colleagues.

Papers have been written denying the need of engineering in orthodontics. Some writers have failed to grasp the geometric effect on arch form by the slight change in size of a single tooth. In the cuspid region, the curvature (arch form) changes more rapidly. The cuspid tooth, therefore, effects the form of the arch when its size is increased or lessened. Cases have been cited against engineering by dentists as follows: Two monkeys were found with identical teeth, save the upper canines. The monkey with the larger canines had the narrower arch. This evidence confirms the engineer's theories, as, geometrically, it follows, under the foregoing conditions, that the monkey with the larger canine must have a longer and narrower arch; another example to show to what extent the fetish of biology has carried some of our ablest workers.

An orthodontist, in presenting a fine clinic, discussed the use of lingual arches and fine finger springs and stated that we do not use force to move teeth, but delicate wires for tissue stimulation The definition of force follows: any action productive of motion.

In 1914, I started an investigation by measuring and mapping the dental arches of normal skulls at the National Museum at Washington. Some interesting data were obtained, but the need of measuring in three dimensions required an engineer. So, in February 1915, Mr. Rudolph Hanau was consulted. This engineer, with no previous knowledge of orthodontia, constructed the Stanton-Hanau surveying apparatus. In a few months, much valuable information was obtained, which was presented at the Pan-American Dental Congress in 1915. While the paper was on an instrument for mapping the denture, we could not refrain from pointing out some of the fallacies of orthodontic terminology and stated our conclusions as follows:

CONCLUSIONS

1. The form of a dental arch may be described by means of the curve that most nearly conforms to points projected to a plane. The position of the symmetry lines of the curve or its axis, if any exist, should be stated.

2. The position of a tooth in occlusion or malocclusion may be accurately stated by giving its relation to the three axes or planes assumed, i. e., by representing a tooth or parts thereof in at least two projections.

3. A tooth in malocclusion can be rotated only on an axis, such axis to be assumed in the tooth itself, or bodily displaced, or both rotated and bodily displaced. Disharmonies in tooth position cannot be accurately enough detected on the plaster casts by the eye.

4. In the treatment of malocclusion, curves in three dimensions should be selected that require the least tooth movement to place the teeth in normal occlusion.

5. An instrument has been needed to record properly the relation of the teeth.

6. A practical method has been lacking to bring before the profession proper records, such as are required in exact science.

7. The surveying apparatus enables one to make all possible measurements.

8. The new method of investigation indicated in this paper will, for the first time, enable orthodontists to eliminate guesswork, and therefore substitute scientific reasoning.

I would not alter these conclusions today. A second engineer, Gilbert C. Fish, designed the occlusograph for determining the proposed arch in any given case of malocclusion.

The problem of measuring the dental apparatus presents no difficulty, as long as the approach is made along orthodox lines; but as long as dentists cling to such terms as mesial, distal, versions and lines of occlusion, nothing but chaos will result. Orthodontia touches many collateral sciences. Whenever possible, we should adopt the

terminology of the collateral science. We should agree on the method of approach of measuring and defining the form and dimensions of the dental apparatus and surrounding structures.

Three planes at right angles having a common point of intersection should be related to the head in some definite way applicable both to the living patient and the cadaver. The method of relation should be precisely stated. The point of origin (point common to the three planes) should be designated O.

Coordinates should be designated x, y, z; x to mean right and left in the head, y to mean front to back in the head and z to mean up and down in the head; the horizontal plane to be x y plane; the sagittal plane to be y z plane, and the tranverse plane to be x z plane. Some dental authors in writing on three reference planes for the head have used other letters than x, y, z. This is most unfortunate and should be avoided in the future.

When three planes are related to any structure of the head (such as the denture and palate), it should be borne in mind that the planes extend to infinity and embrace all points of the head. This does not seem to be clearly understood, as some dental authors have criticized the engineers for not relating our maps to the head.

Each problem of terminology should be classified as to the collateral field it touches with the possibility of getting aid from the collateral science. For example, the committee on terminology very justly criticizes the use of expansion arch, as the term arch is also used to designate the denture. The English have suggested the term bow instead of expansion arch. Let us ask ourselves what field we must turn to for aid in this case.

The expansion arch is a mechanical device; naturally, the correct term would be found in mechanics. An engineer, if consulted, would probably suggest to the committee on terminology that the expansion arch is a beam, for a beam is defined as "a bar of any form which is supported at two or more points, and thus enabled to resist the action of forces applied transversely to its length."

Elastic wires in orthodontics act in accordance to Hookes' law: double the size of wire, and the force is increased sixteen times.

Where there is faulty mechanical relation of the teeth (traumatic occlusion), the modern practice is to grind the natural teeth carefully into a good mechanical fit in order that damage to and disease of the supporting structures of the teeth may be overcome.

When artificial teeth are to be made for a patient, modern practice demands that the movements of the jaws be carefully recorded and that precise instruments be used to duplicate the jaw movements. Also, in operative dentistry, fillings, crowns and bridges are to be made to reproduce precisely the tooth anatomy, for the best health of the supporting structures and the prevention of periodontoclasia, and because of the necessity for artificial dentures.

So in orthodontia, the goal should be to establish, at the earliest age, the best mechanical relations of the teeth, to prevent the dire results of traumatic occlusion and insure for the teeth and surrounding structures the best health conditions; and also to obtain the best conformation of bone, adjacent to the teeth, that may be obtained through normal functioning of the teeth mechanically.

What information has mensuration

of skulls and models produced of benefit to orthodontists? In what manner has the work of engineers influenced the treatment of malocclusion? While much of the data available to answer these questions have been previously published, it seems worth while to reassemble some of this published matter

Dr. Denzer, a physician, took impressions of the mouths of thirty-nine babies at the Babies' Hospital, and compared the models, publishing the findings. Before attempting this arduous task, Dr. Denzer went over the previou medical literature carefully and could find no precise work previously done. Children, aged 6 years, with all of the deciduous teeth in regular alinemen but without large spaces between the deciduous teeth in regular alinement some of the Denzer series, show dental arches no larger than the baby arche during the first year of life. When models have been made at 5 years and the case untreated until 10 years, there is but slight growth in the width of the arch in the bicuspid region, and in such cases, the permanent incisors must either overlap or rotate on a mesiodistal axis, which causes the incisal edges to appear in the maps further in front of the temporary incisors.

In Keith's illustrations of the direction of growth, it is seen that the in cisor teeth move forward 40 mm. and grow downward. As the maps show that there is little change in the form or size of the dental arches (section occupied by deciduous arch), we conclude that the growth of bone and the movement of the dentures have been due to enlargement of the bones of the face and cranium in regions other than the sections of the maxillae containing the deciduous teeth. In the cases observed at 5 years, in which there is not room between the temporary cuspids for the four permanent incisors, I know of no good evidence to prove that the dental arch will grow, unaided, in width to contain the permanent incisors in normal occlusion.

Mapping has shown that, as the jaws lengthen to accommodate the permanent molars, the palate tends to assume a more normal width in the region of the first permanent molar, as evidenced by this tooth, on eruption, taking a position outside the distal end of the temporary arch. The narrow temporary arch causes the mesial end of the first molar to rotate to make contact with the second temporary molar, leaving the distal end of the first permanent molar more nearly in correct position. When the second permanent molar erupts, the palate has succeeded in developing a normal width, and the second permanent molar region rarely needs to be widened. From the foregoing, we deduct that malocclusion is basically a failure of the palate to widen sufficiently in the region of the temporary molars and a failure of the premaxilla to grow for the alinement normally of the incisors. If the arrest is extreme in the width at the temporary molars, the "saddle arch" will be produced, as the palate will still be normal at the second permanent molar.

These precise data have been made possible by the use of precise, orthographic mapping instruments. Not only is the mapping method of the engineer valuable for orthodontists, but it has also been of service to anthropologists.

Of further use to orthodontists has been the study of the form and dimensions of normal dentures by means of orthographic projections. In projecting dentures of normal skulls and models

of normal cases, it was found that the following dimensions were the limit of normal occlusion: from 52 to 62 mm. at the first molar; and from 21 to 34 mm. in length of the arch. While the index of the palate was known to the anthropologist, I feel that this range of variation should be of service to orthodontists.

The study of normal models has revealed the position of the teeth—the normal inclinations; a valuable addition for the teacher and a simple means of adding to the student's knowledge of normality. The following study of a normal model will illustrate my meaning: The upper map discloses at a glance the abnormal rotations of the left lateral and right second bicuspid, which is tipped outward. This tooth normally stands vertically. The outer and inner cusp should be equal distances from the gum line.

The left lateral is rotated on two axes as shown by projection of the incisal edge. All other teeth are normal for the white race.

All teeth appear the same in the horizontal projection, except in the incisor region. In the whites, the incisal edge usually appears as shown in this map. In the negro, the incisal edges flare outwardly and appear in projection outside the gum line. In the yellow races (Japanese), the incisal edge appears on the gum line.

Information *re* the Japanese type was obtained from surveys made by Mitsura Okada on Japanese medical students at Kyoto Medical University.

The lower arch shows the typical inclinations of the white race. It appears that the simplest way to teach dental students is by the use of the orthographic projections. It should take but a short time to teach the appearance of the teeth in normal occlusion, as maps show the slightest error of inclination of the teeth.

The next contribution of the engineer is a method of finding the centroid of the denture and the "axis of symmetry." If orthographic maps of normal dentures are made, it will be found that there are axes in three dimensions in respect to which the denture is symmetric. The following illustrations show the symmetry of the Eby case. As the precise formulas (for finding centroid and axis) are published in "Arch Determination, Etc.," they will not be given here.

The value of precise instruments for mapping is shown by the cross-sections of the Eby case. Study of the overbite and palate cross-section of the molar region shows the precise relation of the upper and lower molars (front elevation, side elevation and development).

The next contribution of the engineer is a method of comparing forms of dental arches. The engineer has suggested that we relate the denture maps by means of the denture centroid and axis of symmetry.

The next contribution of the engineer is the instrument called the occlusograph, an instrument that permits the arrangement of the teeth in any case of malocclusion in any proposed plan of treatment, and has the advantage of being adjusted over the map of malocclusion. Its use has been thoroughly discussed in a previous paper.

The most important contribution of the engineer is the formula for placement of two maps (occlusion and malocclusion) in such a way; as, the sum of the squares of movements to change from the configuration of malocclusion to occlusion is a minimum.

CONCLUSIONS

1. Orthodontic societies could with profit employ a mechanical engineer.

2. All dental and medical schools should add an engineer to the faculty and equip a machine shop and permanently employ skilled mechanics for experimentation and the development of medical and dental instruments.

3. The dental and medical engineers should work in conjunction with anthropologic societies: (1) to develop highly specialized measuring instruments; (2) to investigate evolution from the mechanistic point of view (under the direction of anthropologists).

4. The American Dental Association and state societies should permanently employ mechanical engineers, and also engineers of scientific management.

5. A text is needed to cover the present development of engineering, as used in general dentistry and orthodontia.

DISCUSSION

Abram Hoffman, Buffalo, N. Y.: The field of diagnosis offers an opportunity for the best minds of our profession, and it should be our desire to assist in every way those who are so unselfishly contributing, no matter in how great or small a degree, to the solution of the problems. We are in the midst of a maze of ideas, each donor earnest and sincere. More definite, positive and scientific methods are an absolute necessity in our daily office routine. A finer differentiation must be arrived at. We have in a large degree been devoting ourselves to the refinements in methods of treatment, getting the cart before the horse, as it were; for the first essential is an appreciation of etiology and diagnosis. A mere oral examination or examination of plaster casts is wholly inadequate and may be likened to the empiric plan followed by misguided dentists sending a plaster cast to the commercial laboratory for an outline of the etiology, diagnosis and treatment: it can't be done. The simplest malocclusion can perhaps be handled by simple diagnostic means, but, without question, further development of diagnostic methods is absolutely necessary.

Norman L. Hillyer, Brooklyn, N. Y.: This paper again brings before us the crying need of a better understanding and application of engineering principles to our work in orthodontics. For years, there seems to have been a battle waged between the exponents of biology, anthropology and art, on the one side, and the followers of mechanics or engineering on the other. It seems impossible to reconcile these two factions into a unit which would function along the lines of biomechanics, a happy and useful combination suggested by Dr. Hellman in 1920. This, to my mind, is absolutely necessary to the future progress of orthodontics. I agree in full with the conclusions in the paper given by Dr. Hellman before the Dental Society of the State of New York in 1920: "That Orthodontia, as a whole, can, under no circumstances, be regarded as a problem in mechanics alone," and "that the tissues involved in orthodontic procedure do respond to mechanical forces but not in accordance with physical laws." I also believe that orthodontia, as a whole, cannot be regarded as a problem in biology alone and that, because scientific and accurate methods of diagnosis, of treatment plan and of construction of mechanical appliances for treatment of irregularities of the dental arches must be perfected, engineering or mechanics must play a great part in our studies and researches. In this connection, it seems that both Dr. Stanton, in his previous and present presentations, and Dr. Simon, in his great work, have given us things which, if combined and carried out by some future research worker, will lead to a result of inestimable value to all practitioners of our specialty and undoubtedly to workers in the kindred fields of prosthodontics and periodontics; for Stanton has gone beyond Simon in giving us a useful individual norm for comparison and treatment, since, in my judgment, Simon's norm is not applicable to all races and all types, and, therefore, should not be the standard for diagnosis. Stanton, further, has given us the Stanton-Hanau surveyor, and the occlusograph, and the method for their use, which, to everyone who has applied them, has proved a very necessary part of proper, scientific, orthodontic diagnosis. Simon, on the other hand, has given

us models that bear a universal relationship and convey a meaning not given by models of any other investigator. Simon's photostatic methods, too, are a big step toward standardization of photography for orthodontists, and, because they are standard and easily measured, are indispensable to proper diagnosis and treatment. What a scientific and useful member would a man be who combined all these methods into a future method for diagnosis and treatment! The terms x y z, as proposed, seem preferable to the ambiguous abc terms, and Dr. Stanton is right in pleading for a well-understood, uniform terminology in orthodontics. His suggestion of the substitution of the term "beam" for "arch" seems a little incongruous, for the term "beam" has many diverse meanings which do not apply to the arch that we think of in our work. Webster gives some of the various meanings of "beam" as (1) a long piece of timber or iron used horizontally or vertically to support the rafters of a building; (2) a collection of parallel rays of light emitted from the sun or other luminous body. (3) the oscillating lever which transmits motion in a steam engine. There seems to be no dental or medical use of the term "beam," and the meaning given in the "Mechanical Engineer's Handbook" is "a bar resting on supports near its ends." None of these meanings convey to me the form, size, function or inherent qualities of the appliance for which we seek an adequate term. This, perhaps, is beside the point, but it shows the need of, and difficulties of, obtaining an inclusive terminology for orthodontics. In his conclusions, Dr. Stanton states that orthodontic societies, dental and medical schools and societies, and anthropologic societies should all employ mechanical engineers to aid them in their work. Perhaps that would help toward the happy combination of which I have spoken, but I would rather see the biologist taught engineering by the engineer, and the engineer taught biology by the biologist. In that way, two men of scientific thought would spring up to do careful scientific work in their respective fields.

CONTROL OF CARIES IN THE ANTERIOR TEETH BY MEANS OF FILLINGS*

By HARRY A. TRUE, D.D.S., Des Moines, Iowa

THERE has probably been no time in the history of dentistry when so much has been accomplished to prevent the ravages of caries of the teeth as the present, and probably no locality in the world where more is being done than in Chicago. However true this may be, we realize that a great deal more must be accomplished before caries is subdued. Oral hygiene, proper diet, periodical visits to the dentist, examinations of the mouths of school children, etc., have a great effect on the reduction of the number of cavities developed, but, at present, there still remains much work for us, as operative dentists, in controlling caries in the anterior teeth by means of fillings.

Since caries results in the dissolution of tooth substance, thereby making a cavity, we must replace the destroyed portion of the tooth with some material so as to restore the tooth to its original shape and size. This procedure, as has been suggested, we term, making a "restoration" instead of a filling, as the term "filling" signifies the complete closure of a hole but does not give the idea of the contour which is so essential in the restoration of the anterior teeth.

*Read before the Midwinter Clinic of the Chicago Dental Society, Jan. 27, 1927.

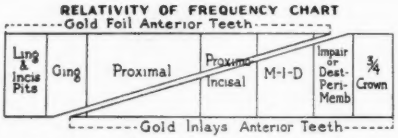

Fig. 1.—Relativity of frequency chart.

While this paper deals almost entirely with permanent teeth, something should be said about deciduous teeth. I believe that the most important reason for restoring decayed deciduous teeth is to protect the pulps from becoming putrescent, with subsequent abscesses. Systemic absorption from these septic localities is quickly and severely manifested in children, causing heart lesions, rheumatic fevers, etc.

The procedure then advised is to do anything, using tact, patience, wit and perseverence, to take care of all cavities before pulp involvement. Esthetic conditions are secondary, but of course should be taken into consideration whenever convenient.

One little patient was brought in for attention when only 13 months old, one of the upper central incisors having decayed on both the mesial and distal surfaces, including the angles. A few

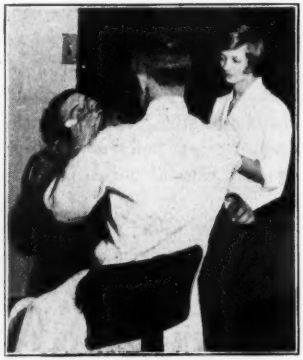

Fig. 2.—Position of patient and operator.

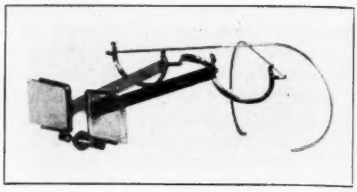

Fig. 3.—Binocular lenses.

short strokes with a small spoon cleared the cavities. The incisal edge was shortened with a small stone. The remainder of the crown was lassoed by a measuring wire and a gold crown constructed and placed. The other three upper incisors decayed in a similar manner shortly after their eruption and were handled in the same way, and all four teeth carried the gold crowns until the natural time for the teeth to be exfoliated, with no pulp involvement. This is not offered as a routine rule to follow, but was one way of using "tact, patience, wit and perseverence" to take care of the cavities before pulp envolvement.

May I quote from Arthur D. Black's paper read before the Chicago Dental Society last year:

> In private practice, we should plan to see each child when it is about 3 years old. A first visit at this age should be a pleasant affair for the child, because there will usually be nothing required. The teeth may be

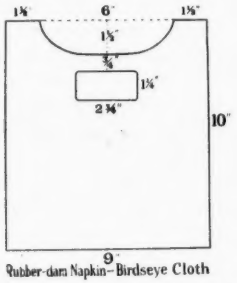

Fig. 4.—Rubber dam napkin.

Fig. 5.—Dam and napkin in place.

cleaned a little as part of the event. What a difference in the attitude of such a child toward dentistry, as compared with the one that is brought for the first time with an aching tooth, very nervous from pain and from loss of sleep, and extraction the only remedy.

It might be suggested to those who have not enjoyed operating for children that the effect of visits under the two conditions mentioned is quite as great on the attitude of the dentist toward service for children as it is on the attitude of children toward the dentist. It may be further suggested that the dentist who will make the effort to have children brought to him at 3 years of age, and every three or four months thereafter, will not only come to have a very different notion of the value of the care of the deciduous teeth, but will get real enjoyment, not only in the friendly relations of child contacts, but also in the satisfaction in later years of seeing many of these children grow to adult life with a full complement of teeth with vital pulps and healthy peridental membranes.

Fig. 6.—Chair with pillows.

Fig. 7.—Outline for cavity preparation.

The remainder of the paper will be devoted to a consideration of the permanent teeth.

Temporary restoration materials are those placed in cavities in order to hold the situation "as is" for a limited period of expectancy, which may be for a day or two, or a few weeks or months, until a more convenient time for the building of a permanent restoration. Guttapercha, oxyphosphate cements and the silicious cements are classed as temporary materials.

Permanent restoration materials are those used in the building of restora-

Fig. 8.—Overhanging enamel chipped down with chisel.

Fig. 9.—Forming gingival wall to labial.

Fig. 11.—Extension labiogingival angle.

tions which are indestructible in the fluids of the mouth and which hold up under stress of mastication for a considerable number of years, or the life time of the tooth. Pure gold in the form of foil, alloyed gold cast into inlays and baked porcelain are permanent restoration materials.

There are at least four materials, namely, silver cement, copper cement, silver amalgam and copper amalgam, the use of which is contraindicated in the anterior teeth on account of color.

The accompanying chart, showing the relativity of frequency in the use of the gold foil and the gold inlay, has been made to cover those classes of cavities in which gold has been decided on for the material to be used and is explained as follows:

Lingual pit cavities in upper lateral incisors should all be restored with gold foil. They are usually small at their orifices but are many times very deep. As the cavity does not point toward the pulp but is parallel with it, there is not much danger of exposing the pulp. One-half of the restoration may be made by placing several pellets of noncohesive gold in the cavity first and then finishing with cohesive foil. The time consumed is hardly longer than in filling with cement. The stress from the opposing teeth may play upon this restoration a lifetime and have no particular effect on it.

Incisal pits from faulty development, and abraded incisal surfaces, are built entirely of cohesive gold because they are usually not so very deep and need all the strength possible to secure anchorage.

Fig. 10.—Forming gingival wall to lingual.

Fig. 12.—Extension linguogingival angle.

Fig. 13.—Securing depth to labiogingivo-axial and linguogingivo-axial (point) angles.

Most of the gingival cavities are small and narrow but have their gingival margins beneath the free margin of the gum, and when restored, this gingival margin should be as free as possible from any irritant. The foil restoration meets this requirement better, I believe, than does the inlay with the probable cement margin. When larger cavities occur at the gingival line, causing disease and destruction of the peridental membrane, the gum should be anesthetized and a clean-cut surgical stroke made, removing a portion of the gum so that the prepared gingival margin of the cavity is entirely exposed. Then a foil restoration can be made well and easily.

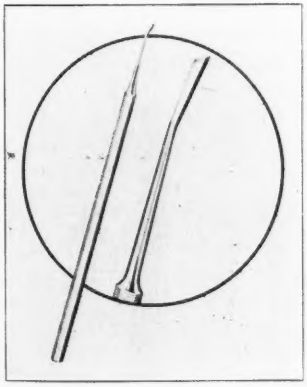

Fig. 14.—Woodbury angle forming instruments.

Fig. 15.—Completed cavity preparation.

This small area of the chart is left for gold inlays in order not to be too radical, and also when cavities of this class occur in teeth having been loosened by impaired or destroyed peridental membrane.

Proximal cavities in anterior teeth are restored by foil instead of the inlay for several reasons:

1. The length of the margin prepared for foil is less; which reduces the possibility for failure in proportion to the reduction in the length of the margin.

2. Retention is more firmly established on account of the undercuts.

3. Better margins are assured because the foil covers the enamel rods of the cavosurface bevel.

Fig. 16.—Triangular bar.

Fig. 17.—Overhanging enamel chipped down with chisel.

4. Contact point and separation are secured as the operation is made by wedging against the approximating tooth.

5. The operation is completed in one sitting.

6. The restoration is more easily finished.

7. The time consumed for the operation is shorter.

8. There is less cutting and less pain.

9. Conservation of tooth structure is assured.

10. The cement line is eliminated.

11. Danger from tooth discoloration is reduced to the minimum. No shadow is cast from discolored cement.

12. The cavity is prepared under the rubber dam with less pain because of dryness.

Fig. 18.—Covering lingual wall.

Fig. 19.—Incisal anchorage filled and incisal wall covered.

13. There is no contamination of the cavity by saliva; instead, the cavity is surgically clean and, while in this condition, is filled with an absolutely sterile material fresh from the flame. Therefore, the most important point is secured: safety to the dental pulp.

14. The interposed film of cement is eliminated and the material is wedged directly against the elastic walls, this securing a better adaption, excluding moisture and bacteria, and insuring a more enduring restoration than can be

Fig. 20.—Black knife for trimming filling.

Fig. 21.—Extra wax on all margins.

made with any other known material or technic.

This space is reserved for operations for dentists who will do no foil work and claim that as good restorations can be made with gold inlays.

The smaller of the proximo-incisal restorations can be made with comparative ease by successful operators in gold, and there is no possible chance for a cement line to show either at the time of making the operation or later. However, many gold inlays can be made here approaching perfection (for gold inlays) on account of the access and parallel walls.

A few of the mesio-incisodistal type are placed in foil because of the wonderful quality of all margins, and in the mouths of patients who have a tendency to sleep (and many do go to sleep while the malleting is being done), foil is indicated. The access is very good in cavities in the upper teeth, and while both the operator and his assistant are sitting and the patient is in a comfortable recumbent position, the restoration is completed in about the same time and with the same ease to the operator as in the inlay. When we consider the possibility of discrepancies during the taking of wax patterns, investing, burning out, shrinkage in casting and the accident of spoiling a margin while finishing the inlay, it seems we are justified in making foil restorations in quite a number of these mesio-incisodistal cavities.

In making gold inlays in these complex cavities, great care should be exercised in every detail. A particular reason for the use of the inlay is that a large bulk of gold may be cast as easily as a small amount.

Since teeth which have become loosened by impaired or destroyed peridental membranes should not be subjected to long malleting, the inlay should be chosen, unless the cavity is extremely small.

Three-quarter crowns speak for themselves. In these, we need a harder gold than the pure metal. They are very useful in large restorations and especially in bridge construction.

The chart, as you will notice, covers classes of cavities where only gold is used. The porcelain inlay is used solely for esthetics, and when used where it is indicated, is a wonderful material for restorations. It is indicated in large labial cavities and a few well chosen proximal cavities in mouths of patients who particularly demand the esthetic. I am doubtful that it should be used in proximo-incisal restorations, unless by the most experienced and skilful operators, and then in carefully chosen places.

In order that I may know how many of the dentists present are using gold foil anywhere in the mouth, the following grouping is presented:

Group III. Those making none; or perhaps from one to five gold foil restorations in a year.

Group II. Those making from five to several, or, say, a few now and then.

Group I. Those making many, or

probably every place where foil is indicated.

It is not the intention of the paper to give in detail all the methods of restoring the anterior teeth with gold and porcelain, but there should be mentioned a number of details which are many times slighted or overlooked.

Gold foil technic in dentistry corresponds to vocalizing in the art of singing; scales and phrasing in instrumental music; calisthenics in health exercise. It is a sort of governor which keeps us from being careless; holds us from too much speed, and develops our ability in all lines of dental operations.

I wish to mention some of the equipment which is essential in gold foil dentistry.

1. For the examination, a good clean unscratched mouth mirror, a fine explorer, an air syringe or compressed air to blow saliva from between the teeth, and binocular lenses or their equivalent. These glasses magnify considerably and make the examinations more thorough and easier. What would you think of a jeweler to whom you have entrusted your watch for repairs not using a magnifying glass, even though his eyes were normal? As many proximal surfaces are very close to the approximating teeth, making it impossible to examine with an explorer, in order to complete the examination the roentgen ray should be utilized.

2. For the preparation of the cavity, the rubber-dam, which should be firm, 6 inches by 6 inches and of a dark color. The rubber-dam napkin (Fig. 4) of two thicknesses of birdseye cloth is easily applied, stays in place well and is so comfortable to the patient that, after once used, one would feel ashamed to apply the dam without it. The Woodbury rubber-dam holder, with its two straps and three snaps, holds the dam in place. It is the displaced and loose wet rubber that is so uncomfortable. When properly placed, little, if any, discomfort is present.

Sharp cutting instruments of the G. V. Black pattern and including the angle-forming Woodbury instruments are essential. Sharp burs including the left hand cutting inverted cone burs complete the list for the preparation of the cavity.

An alcohol lamp, michrome wire foil carrier, gold pluggers and the Prime hand mallet in the hand of a woman assistant comprises the equipment for the placing of the gold.

To take a specific instance, say a cavity that is in the mesial surface of the upper left central, the procedure for the operation, to state the steps briefly, is as follows:

The patient is seated in the chair adjusted to fit the back and head in a comfortable position. This is made possible by the means of two pillows, one placed in the hollow of the back and the other under the head. The rubber-dam is placed over the anterior teeth including the first bicuspid on either side, the operator using, of course, one of the napkins. If the second bicuspid is present, a ligature made from a small strip of rubber dam which has been twisted tightly, is placed between the first and second bicuspids on both sides of the mouth. The twisted rubber is released and the ends are cut off. There will be no need of a clamp. It does not infringe on the gum and does not separate the teeth because it is placed just beneath the contact point. The margins of the holes are turned root wise under the free margin of the gum. A silk ligature is very seldom needed unless the cavity extends gingivally. A

small round bur is placed through the labial surface near the approximating tooth into the cavity, then the undermined enamel, incisally and gingivally, is broken down with a small chisel. The round bur is next carried on through the lingual wall and the undermined enamel chipped out. A No. 34 inverted cone bur introduced from the labial and lingual forms the gingival wall. The left hand inverted cone bur revolving to the left or backwards extends the cavity at the labiogingival angle and the right hand inverted cone bur extends the cavity at the linguogingival angle for "extension for prevention."

Chisels plane the walls to outline form. As large a round bur as will enter the cavity makes the axial wall slightly concave, exposing all portions of the cavity to view. A No. 000 round bur, which is smaller than the No. ½, secures depth to the labiogingivo-axial angle and the linguogingivo-axial angle. The incisal retention is made solely with the No. 33 or 34 inverted cone bur introduced from the labial by placing the bur as nearly to right angles to the axial wall as possible and moving toward the incisal. This makes just the right kind of retention form with the least possible destruction of tooth substance, which it is so essential to retain at this particular point. The gingival retentive angles are squared out with the right and left Woodbury angle-forming instruments. The beveling of the cavosurface angles completes the cavity preparation.

The gold is prepared by cutting the sheets of No. 4 foil into sixteenths, thirty-seconds, sixty-fourths and one-hundred twenty-eighths, and rolling into balls. The building is started with one-hundred twenty-eighths in the linguogingivo-axial angle and building along the axiogingival angle toward the labiogingivo-axial angle, well against the axial wall. After this triangular bar is finished, the holding instrument may be dispensed with and the building continued out over the linguogingivo-axial angle; then forming a triangular ridge covering the lingual wall and building toward the incisal, reinforcing this triangular ridge to the gingival and labial very little, we leave the labial portion of the restoration to be made last. The incisal anchorage is now filled and the incisal wall and margin covered. These apparently difficult portions of the cavity have been built in with ease because the access has not been cut off by the gold in the labial portion of the restoration. Then the labial portion is very handily built in last.

The finishing is accomplished with the small fine carborundum stones on the lingual surface. The proximal surface is trimmed with the No. 7 cone socket Black knife held in a large cone-shaped wooden handle. This large handle allows a well secured grip on the knife.

As a lad, I one day picked up a discarded razor and carefully placed the cutting edge against my finger. To my surprise, it did not seem sharp, so I thought it safe to play with, but as I carelessly drew it along my finger lightly, there was suddenly a great flow of blood. So it is with the Black knife: do not hook the blade over a large bulk of gold and pull straight against the mass, but rather make shavings or whittlings, drawing the blade as a razor is drawn over the face in shaving. The gingival and all the proximal surface except the contact point may be shaped by this sharp knife handled properly. A

disk on the labial surface and a strip or two on the proximal surface finish the restoration, except the contact point. A separator is placed, and the small contact point is finished with the knife and a fine strip. A polish is made with the Burlew sulci disks or extra fine cuttlefish disks, but not so bright a polish as to make a mirror-like surface, which would reflect the light, making a glaring surface or a dark surface according to the direct rays of reflection.

The building of the gold in a cavity having a left exposure, for instance a cavity in the mesial surface of an upper right central incisor, is accomplished by using both a right side position and a left side position at the chair. After the triangular bar is finished and the linguogingival angle is covered a large bulk of the restoration is built with the operator approaching the patient from the left side of the chair.

G. V. Black has said that the form of a restoration is of more importance than the color. In the anterior teeth, tooth form is not only more important than color but also more important than contact. In the bicuspids and molars, the reverse holds true: the contact is of more importance than tooth form.

Gold inlays are made by three methods: direct, direct-indirect and indirect, each having its advantages for certain operations. The direct method, the shortest and simplest, is used in small restorations. The direct-indirect is used when considerable carving is to be done which can be accomplished out of the mouth easier. The indirect method is used in the construction of large inlays and three-quarter crowns. This indirect method has the advantage of an amalgam model over which the wax is carved and the cast inlay swaged and finished. An important detail in waxing, when the amalgam model is used, is the placing of a bead or rim of wax along the gingival margin thus thickening the thin edge, which sometimes fails to cast. This thick margin is quickly finished flush with the margin on the amalgam model and polished on the lathe, after which no finishing of this margin need be attempted after setting with cement.

When porcelain inlays are used in labial surfaces on account of the esthetic effects secured with porcelain, the cavities should be made with sharp definite margins all perfectly free from the gum. An impression is taken with black modeling compound forced in to all points of the cavity with a flat piece of metal which has been cut to approximate the whole labial surface of the tooth. Ice water is used for chilling. From this impression, an amalgam model is made and a platinum matrix swaged with an hydraulic swager and burnished with steel instruments.

The porcelain powders should be washed before they are used in the building of the inlay. A bottle one-third full of powder is filled to two-thirds full with distilled water. The bottle is shaken and the powder allowed to settle for ten minutes. The amount of black specks and dirt floating on top of the water is noted, and all the excess water is decanted. This is repeated a time or two.

Small portions of the low fusing porcelain is biscuited in the matrix, and the final burnishing of the platinum matrix should be done in the cavity of the tooth in the mouth. Cocoa butter is now spread on the excess platinum right up to the margin of the cavity, and when the last portion of the powder is vibrated, it flows to this cocoa buttered margin and does not flow over onto

the excess platinum. When baked, a sharp definite margin is thus assured the inlay. Low fusing porcelain seems to bake without the probability of bubbles forming, and, as strength is not so essential in these labial restorations, the low fusing porcelain is strong enough. When these are set with "kryptex," they make beautiful restorations.

Teeth are such wonderful works of art and mechanics that we should do our utmost, when cavities occur, to restore them to the form with which Nature has so beautifully endowed them. Let us study, therefore, to develop our skill in art and mechanics; for if we attempt to restore destroyed tooth substance, we owe it to these teeth, to our patients and to Nature, to replace those surfaces with just as good replacements as possible, in order that the usefulness of the tooth shall go unimpaired and maximum protection from the recurrence of decay be assured.

DISCUSSION

Don M. Gallie, Chicago, Ill.: The generally accepted definition of the word discuss is to debate or argue the subject presented. When I read Dr. True's paper, I concluded that my discussion could not take the form of debating or arguing, but instead, I must acquiesce in the principles presented. I may differ in some of the details of technic, but not in the principle. It is encouraging and hopeful, indeed, that this young man comes out of the West and reminds us, in such an able way, that we must direct our energies more diligently than ever to save teeth. You will agree with me, I think, that, of late years, it would appear from our literature that the profession was more interested in substituting for than in saving teeth. Countless pages have been written on the different types of crowns, and endless descriptions of all kinds of ingenious, but not always practical, partial dentures and removable bridges, and a far greater tendency to clean out mouths for full dentures has been quite apparent. We have witnessed, in the past few years, a wonderful improvement in root canal technic. Splendid scientific papers have been presented on this subject. Aside from the gold inlay, there has been little on the selection of the filling materials and on tooth restoration. Why are there so many pulpless teeth? and why the necessity for some form of tooth substitute? Simply, because caries is permitted to progress unchecked, or imperfect restorations are selected and inserted. We hear much nowadays about this being an age of prevention, as it applies to dentistry. No matter how carefully the question of diet may be followed, or how thoroughly oral hygiene and prophylaxis may be practiced, we will still have carious teeth. Consequently, I believe that the best preventive dentistry is better reparative dentistry. I am glad that Dr. True reminds us that this reparative process applies to the deciduous teeth as well as the permanent ones. What an indictment we have against us in our neglect of the deciduous teeth. The suffering and disfigurement that children have been subjected to is a blot on our escutcheon. There is now a ray of hope for them in the school examination, toothbrush drills, state and local aid, dental infirmaries and, last but not least, the work of the small army of men and women in our ranks who are specializing in children's dentistry. To me, this little army of unselfish men and women are making the greatest contribution to human comfort and happiness. Dr. True next deals with what he calls "temporary fillings;" namely, guttapercha, oxyphosphate and silicious cements. I think that he puts them in their order of importance. Too many overestimate the usefulness of the last named and look on them as a permanent restoration. They do not measure up to the specifications of a permanent filling. First, they are not compatible with the pulp; next, they do not preserve the normal interproximal space, largely on account of faulty contact. We all know that the contact point of all proximal fillings is of vital importance. Not only does a faulty contact point invite a recurrence of caries, but it also is sure to cause disturbance and destruction of the surrounding tissue. The great majority of silicate fillings, sooner or later, show marginal imperfections necessitating replacement, as much of the material has no adhesive properties. Wherever we find discolored margins, we find decay. This must be removed, enlarging the cavity. A few replacements will mean envolvement of

the angle. In considering the question of permanent restorations for anterior teeth, I would put them in the following order: gold foil, porcelain, gold inlay. Why foil first? Because, there are more types of cavities and more surfaces that can be perfectly filled with foil than with any other material; namely, all structural defects, such as pits on lingual surfaces. The average proximal fillings, especially those on the distal surfaces, are not conspicuous as they do not come in direct line of vision. A large percentage of mesial fillings should be of foil, all proximal cavities in lower teeth, all gingival third cavities in the lower anterior teeth and many of the gingival thirds in the upper teeth in mouths where the upper third of the tooth is not shown. Practically all incisal edge restorations necessitated by abrasion should be filled with foil. Why should we fill this type of cavity in any other way? The incisal edge is worn down, exposing the dentin, surrounded by enamel walls. A simple box cavity is indicated, of a depth of about 0.5 mm., with surrounding walls paralleled, slight mesial and distal anchorage, the foil easily and rapidly inserted, and finished without trouble. The result is: no gold visible, no discoloration and a filling that should last a lifetime. I cannot subscribe to the placing of gold inlays in simple proximal cavities. I do not believe that I have seen a perfect one. I can hardly conceive of any proximal cavity that cannot be filled better with foil than with an inlay. In handling the incisal angle restorations, there are cases in which the inlay may be indicated, especially if it will permit of a labial restoration with porcelain, and these are mesio-incisodistal cavities that call for inlay restorations; but I believe that the majority of incisal angle restorations are better made of gold foil or gold and platinum. I have in mind some of these restorations as made by the old operators and those expert foil workers that developed after Black had given us his principles of cavity preparations. The contour of those restorations were perfect, the margins faultless, and they will stand up for a lifetime. The incisal angle inlay is frequently displaced. Every operator has some particular hobby about working foil. I prefer the hollow center cylinder, so perfectly made, in preference to the sheet foil, and the making of your own pellets. In the manipulation of foil, the most important step is the perfect adaptation to the walls of the cavity. This is far more important than condensation. I like to place every pellet or cylinder just where I want it, adapt it well with hand pressure and then have my assistant condense with the steel mallet, using a rapid and springy blow. In the finishing of foil fillings on anterior teeth, I have never been partial to the use of the knife. I prefer files and strips. I never use and never allow a student to use a disc in the interproximal space, and I discourage the high rouge finish. I prefer the soft velvety finish. Many of the older men recall the porcelain renaissance of dentistry about twenty-five years ago. Many operators cast aside their gold instruments, declaring that porcelain was the only material to restore carious teeth, especially anterior ones. There developed a number of very skilful operators in porcelain. Their restorations were beautiful and, in countless cases, perfect and lasting; but there were many who had the idea that it had no limitations, that it could be used everywhere. The result of this poor judgment and their lack of skill was that much of their work was a failure. Porcelain fell in disrepute, and, for a number of years, little was heard about it. I believe that there is now great evidence of a revival of interest in porcelain. It has a great field of usefulness. Most of the gingival third cavities in upper teeth call for this kind of restoration, and many proximals can be beautifully restored by its use. If the bite is favorable, angle restorations can be produced to look well and give excellent service. I will look forward with interest to the answers to the questions that Dr. True has put. Those of you who heard or read Dr. Prime's article before the Chicago Dental Society a few years ago will remember that he sent out a questionnaire to about fifty of the supposedly outstanding operators of the country, asking them what materials they used in making restorations. There were a number that were using no foil whatever and there was a large percentage using some one of the silicious cements.

CONTROL OF CARIES IN POSTERIOR TEETH BY MEANS OF FILLINGS*

By RALPH R. BYRNES, D.D.S., F.A.C.D., Atlanta, Georgia

THREE fundamental factors entering into the prevention of dental caries are diet, oral prophylaxis and mechanical restorations, or fillings.

The factor of diet has been almost entirely ignored by dentists in the past. Only during the last decade or so has the importance of this factor been demonstrated by research workers. Drs. McCollum and Howe, and others, have recently thrown a revealing light on this hitherto obscure subject, and are at the present time conducting investigations which will, no doubt, vastly increase our knowledge of dietetics.

The factor of oral prophylaxis as an inhibitor of dental caries has been recognized by the dental profession for some time. But, strange to relate, there does not seem to be much lessening of dental caries since the recognition and teaching of the importance of oral prophylaxis. In fact, to quote Dr. Howe,[1] "Statistics show at the present time the incidence of dental caries is from 95 to 98 per cent." This is a greater percentage than that which obtained forty or fifty years ago. This increase has occurred notwithstanding the practice of oral hygiene and the more recent knowledge of diet and its relationship to dental caries.

In view of these conditions, from a practical standpoint, it would seem that the factor of fillings, or dental restorations, is the most nearly exact of the preventive measures. The factor of fillings as a preventive of dental caries also has been recognized much longer than the other two factors.

Theoretically, perhaps diet is of the greatest importance; but it cannot be considered of the greatest practical importance, in the light of our present limited knowledge of that subject. If all of the theories of proper diet were carried out, and if all of such theories advanced were sound, probably there would be no such thing as dental caries. But neither the dental profession nor any other profession will ever be able to inculcate so deeply into the minds of the people the truth regarding proper diet as to inspire them to prepare their foods with scientific precision. Meticulous observance of a strictly proper diet might eliminate not only dental caries, but also a large percentage of other ills to which the human family is subject, even including many contagious and infectious diseases. Some people, of course, would attempt a proper diet if advised to do so, and even the majority of people might endeavor to follow it at times; but none will ever adhere to it 365 days in the year. In other words, presuming that our knowledge of the relationship of diet to the teeth is ex-

*Read before the Midwinter Clinic of the Chicago Dental Society, Jan. 27, 1927.

1. Howe, P. R.: A New Research on Dental Caries, Dent. Cosmos, 68: (Nov.) 1926.

haustive, and, further, that all of the dentists of the world should preach the advantages of oral hygiene continuously, only a small proportion of the world's population would heed and follow such teaching, and we would still have dental caries. As long as woman is aware that man's heart can be reached through his stomach, mere man cannot be expected to substitute scientific diet wholly for the gratification of primitive appetite.

Prophylaxis, as a preventive of dental caries is, of course, important; but it is not nearly so important as the tooth-paste manufacturers would have the public believe. It would seem that the need of prophylaxis is chiefly a consequence of the lack of proper diet.

The factor of fillings in the control of dental caries is an intensely practical one, which has been recognized and accepted in the past, and which unquestionably will continue to exist in the future. Regardless of the cause of dental caries, whether that cause be lack of prophylaxis, lack of proper diet, or both, we know that tooth structure *is* susceptible to caries and that it actually is being destroyed. The damage is occuring with appalling rapidity. Something must be done to check it, and, so far, nothing has been so effectual as the employment of the various filling materials. Also, we know that certain portions of teeth, by reason of their anatomic form and position in the arch, are less susceptible to caries than are other portions. This warrants extension of the margins of fillings into these areas, a practice which has become known as "extension for prevention." The problem of controlling caries, then, as far as fillings are concerned, simply involves the placing of an indestructible substance in the place of tooth structure already attacked by or susceptible to dental caries, after the proper preparation has been made for its insertion. It is a simple, safe and sure procedure, and, what is more, it is most practical.

There are certain dentists who take delight in belittling the importance and the dignity of preparing teeth for fillings. They speak of it disparagingly as the "mechanical side of dentistry." To my mind, this is illogical. It would appear that that phase of dentistry which has done the most toward controlling dental caries is as important as any other branch. In the broad sense of the word, dentistry contemplates the preservation of the teeth and adjacent tissues in a state of health. The end result is important and dignified, regardless of the methods taken to achieve it. The filling of teeth suggests to the layman, and too often to the dentists themselves, nothing more than the mere plugging up of a hole. Laymen do not realize the dignity of filling teeth because the dentists have not impressed them with it. Too many dentists speak to their patients of filling materials as though one were as good as another, and as if the type of filling material and the manner of insertion were a matter of personal preference. Patients do not look on the filling of teeth as a surgical procedure on living, vital tissue, simply because the dentists, themselves, do not so regard it. This attitude accounts for the death of the vast numbers of pulps under fillings improperly prepared for and improperly placed.

When a dentist takes a bur or a cutting instrument in his hand, he is about to begin a minor surgical operation. He is not cutting holes in wood or stone: he is delving into living tissue, and a very delicate one at that. When he removes decay, he is dealing with pathologic tissue; and his responsibility

does not stop simply with the removal or treatment of pathologic tissue: he must replace the lost parts, artificially, to the best of his ability. He should realize at all times that he is dealing with a specialized body tissue, as much a part of the human anatomy as the hand, the foot or the stomach. He should realize at all times that the pulp of a tooth is one of the most delicate and sensitive tissues of the body. Too many teeth are lost through careless consideration or rather inconsideration of the pulp. Authorities claim that, in nearly every case of dental caries, the pulp is more or less involved.

The filling of teeth for the purpose of checking the ravages of caries is vitally important and worthy of the greatest respect and studious consideration. When a dentist restores a single diseased tooth to its original state of usefulness, he has accomplished an important work. The first act of digestion is that of mastication, and it is of the utmost importance that this function be properly performed. The preservation of teeth and the prevention of caries would be of tremendous importance if only the physiologic aspect were considered and no thought given to the detriment to the patient's health as a result of secondary, systemic infection.

The discussion, in a paper, of the control of caries in posterior teeth by means of fillings would, of course, involve the correct preparation of cavities for fillings and the manipulation of the filling materials. As either of these subjects could be made the topic of a very long paper, I shall not go into either fully, but shall mention a few things which I consider of particular importance in the consideration of fillings as a means of preventing caries.

Posterior fillings are generally of three types: gold foil, amalgam and gold inlay. To many, the gold inlay seems expedient for complex cavities and foil and amalgam for the simple cavities. As the majority of patients, for financial reasons, will prefer amalgam restorations, it is incumbent on every dentist to give close attention to this material. There is no reason for apologizing for amalgam as a filling material, where indicated. On account of its cheapness, dentists and patients have been prone to underestimate its usefulness as a filling material. Like all other filling materials, it has its disadvantages, its particular ones being its color and poor edge strength and its tendency to flow under stress. But, in a simple cavity, where it is particularly indicated, it proves a most valuable filling. Amalgam should not be condemned because, in the past, dentists have been careless in manipulating it and in preparing cavities to receive it.

A majority of the failures of amalgam fillings are due to faulty cavity preparation and faulty manipulation of the material. Under faulty cavity preparation may be mentioned the following: negligence on the part of the dentist in carrying out the steps of cavity preparation, particularly the correct beveling of the cavosurface angles; and carelessness in removing all the decay from the cavity, attributing to the amalgam marked antiseptic action, which it possesses only in a minor degree.

There is an impression among a great number of dentists that the beveling of the cavosurface angle of cavities intended to receive amalgam is not necessary. Nothing could be further from the truth. Black says that the cavosurface angle should be beveled at an angle of from 6 to 10 degrees centigrade from the wall of the cavity and

that it should involve one fourth of the thickness of the enamel rods. This, unquestionably, had particular reference to the gold foil fillings. For amalgam, the angle of the bevel should be the minimum, and the involvement of the rods of the enamel should be the maximum, the body of the material being thus utilized as support to edge strength.

To state it differently, the bevel should be long but not at a great angle. In certain instances, it may involve not only the entire enamel wall, but also a portion of the dentin wall as well. Here, too, the necessity for sharp angles at the junction of the floor of the cavity with the surrounding walls must not be discounted.

Under faulty insertion may be mentioned the factor of improper manipulation of the material.

According to W. E. Harper,[2] the three most important details of manipulation which are most neglected by dentists are: the manner and time of mixing; the character of the plasticity; the packing force, and the manner of applying it.

It is a remarkable fact that dentists who may be meticulous in the insertion of gold foil, gold inlays and porcelain are comparatively careless in their consideration of these three fundamentals in their amalgam work. The best dental alloys which are made today for the dental profession represent the end product of the most scientific and painstaking consideration of the properties of the ingredients of amalgam. The proportions of these ingredients have been established after years of experimentation and testing in the laboratories. The alloy is given to us as a scientific product, as nearly perfect as it can be made. But the mixing of this alloy with mercury is a matter which rests with the dentist, alone.

Harper maintains that the proportion of amalgam to mercury need not be exact, but that the mercury should always be in perceptible excess. He claims that more failures result from starting a mix with too little mercury than starting with too much mercury. If there is too much mercury to begin with, of course, it can be expressed before the completion of the operation; but if there is too little mercury to begin with, the filling necessarily must remain weak through insufficient amalgamation. Much has been said about proportions of ingredients in an amalgam mixing process; but the proportions are not nearly so important as the manner in which the mix is made and applied to the cavity. If mixing is incompletely done, the process of amalgamation will carry on even after the filling is inserted, with the familiar shrinkage and expansion. Although machines have been put on the market for mixing amalgams, the good, old-time, hand-propelled mortar and pestle serve the purpose quite well, and possibly better, if the proper care is used.

Mixing should be done rapidly, in from two to three minutes, depending on the quantity of the mix. Of course, some form of accurate timing should be employed. Probably only a few dentists can judge accurately the passage of two minutes, without a clock or watch; but from the number who use the guessing method, it would seem that most dentists are endowed with this unusual power. One of the best timing devices, in my opinion, is a two or three minute glass, the sands of which consume that length of time in falling

2. Harper, W. E.: Amalgam, Its Working Peculiarities and Its Operative Demands, J.A.D.A., 13: 1117 (Aug.) 1926.

from the upper to the lower compartment. This two or three minute glass may be placed upon the bracket table and watched without inconvenience, while the mixing of the amalgam is in process. As a rule, a small mix of amalgam will take about two minutes and a large mix of amalgam about three minutes, according to Dr. Harper.

Another important factor in amalgam fillings which is frequently overlooked is that of force applied in inserting the filling material in the cavity. According to statistics compiled by Dr. Harper, 40 per cent of the dentists use less than 7 pounds pressure in packing amalgam, although from 9 to 15 pounds is required for proper packing. The common opinion that it is easy to put in an amalgam filling is responsible for most of the sloven amalgam work which one sees in the mouths of patients. The placing of amalgam is not an easy task. It requires painstaking care. The only kind of amalgam filling easy to insert is a sloven amalgam filling. A real amalgam restoration requires the utmost of a dentist's ability. The fact that amalgam is an easily adaptable filling material should stimulate the dentist to greater care in its use, instead of "easing him up," as is usually the case. However much we may dislike to use amalgam in the mouths of our patients, particularly in complex cavities, we must remember that there are certain patients who cannot afford anything more expensive. We, as dentists, should realize this, and endeavor to give them the best possible filling of the character that they can afford.

There are a number of inexcusable practices to which dentists, as a body, adhere. Not the least of these is the omission of the use of the rubber dam. Many an amalgam filling has been ruined thereby. It seems to be the prevailing opinion nowadays that rubber dams are made to be used only in school, and that, after graduation, their use may be joyously dispensed with. If saliva were essential to an amalgam restoration, it would seem that the dental manufacturers would incorporate it in the alloy, and save the dentist the trouble. It is not hard to adjust a dam, and the satisfaction derived from working in a dry field compensates for the trouble in applying the dam, even if actual time saved were not an additional reward.

It was my understanding that, in the treatment of this paper, amalgam was to be stressed over inlays and gold foil. It is my opinion that gold foil, when indicated, is by far the best restoration for posterior teeth. As stated before, the inlay would seem to be the most expedient type of restoration for posterior teeth. I hold a brief for amalgam fillings, not for any love I bear, but rather because we shall have them, like the poor, with us always.

I have mentioned briefly a few principles involved in the matter of placing fillings for the prevention of caries. I have hesitated to elaborate on the subject of cavity preparation because that field probably has been covered more thoroughly than any other in dental practice, and anything that could be said on it would be more or less of a repetition. It seems to me, however, that there is one phase of filling teeth for the prevention of caries which has been more or less overlooked by the majority of dentists, and which has not been discussed as frequently in dental literature as some other operative points. I refer to the consideration of the pulp tissue of the tooth. Many a tooth has

been beautifully and scientifically prepared for a filling, which has been applied with precision, and the tooth ultimately has been lost, owing to the laxity on the part of the dentist in preserving vital pulp tissue. What is gained, if a filling, anatomically and mechanically perfect, is inserted in a tooth, if the tooth itself is to be lost within a short time? Prevention of obvious decay is a useless procedure if, within a comparatively short time, the tooth itself is to be prevented from remaining in the arch. Yet this very thing often happens, and if the tooth itself is not lost, the next worst thing happens, the removal of the pulp.

Any one who has observed closely the mental attitude of the average dentist will have noticed that he is so engrossed in the mechanics of his art that he gives little attention to any other feature of it. He works on a tooth as though it were a block of wood or stone, waiting to be hewed or carved. If he is cognizant of the fact that there is underneath his filling one of the most delicate and vascular tissues of the body, he gives little evidence of his knowledge. This reticular, connective tissue of the pulp contains an enormous number of blood vessels and nerves, with comparatively few cells. The blood vessels enter the pulp through the apical and accessory foramina, anastamose freely, and finally terminate in a dense capillary network just underneath the dentin-forming cells, the odontoblasts, which remain throughout the life of the tooth, around the periphery of the pulp. Furthermore, it has been demonstrated that delicate nerve fibrils extend from the extremities of the odontoblasts into the dentinal tubules as far as the beginning of the enamel tissue. In view of the fact that the dentinal tubules furnish a ready route for the ingress of disease-producing organisms in the tooth, and the further fact that the pulp tissue, being highly vascular, is particularly susceptible to inflammation, is it not reasonable to contend that, in practically every case of dental caries, the pulp is more or less involved?

When a dentist speaks of preventing caries by means of fillings, he usually refers only to the prevention of external, apparent decay. He often takes the greatest care in removing carious tooth structure which is apparent on the external surface of the tooth; but does not seem to realize the great responsibility of removing all decay from the floor of the prepared cavity before inserting the filling, or, if it is impossible to remove all of the decay, the responsibility of inhibiting the further progress of caries by specific treatment of the remaining pathologic dentin. This oversight often occurs in the consideration of permanent teeth, but it occurs far more commonly in the consideration of deciduous teeth. Decayed tooth structure is still decayed tooth structure, whether it is exposed to the air or covered by a filling. Most of the organisms causing caries are facultative and can flourish in places practically devoid of oxygen as well as in places where oxygen is plentiful.

In the treatment of a carious deciduous tooth, two things of paramount importance should always be considered: the removal of all decay, or, if that is not possible without jeopardizing the life of a tooth pulp, such treatment of the remaining affected tooth structure as will inhibit the further progress of caries in the cavity. If any discrimination should be made between the treatment of carious tooth structure of a permanent tooth and that of a de-

ciduous tooth, it would seem that the greater diligence should be exercised in removing the decay of deciduous tooth structure. The pulp of a deciduous tooth is more vascular and less definitely organized than the pulp of a permanent tooth. Having a more copious blood supply, the deciduous pulp is less resistant to infection from overlying carious dentin; for it is a recognized fact in pathology that the more vascular a tissue, the more susceptible that tissue is to inflammation.

What treatment should be accorded the cavity of a deciduous tooth from which the removal of all decay is not possible, without exposing or endangering the pulp? There are various methods of treating such tooth structure, and I shall outline a few which have proved very effective in practice.

The use of black copper cement is very satisfactory. It is an easy, plastic filling, and will give satisfactory results for months or even years. Copper salts have an inhibitory effect on caries. The powder of a certain capping cement is claimed to be about 90 per cent black oxid of copper and about 10 per cent oxid of cobalt, the latter ingredient being incorporated for its working qualities. This type of filling may be used wherever its color does not prohibit its use.

Red copper cement also has high antiseptic and germicidal value, and when well set, makes a hard filling.

Silver nitrate should be used extensively in the treatment of remaining carious dentin. When applied to dentin, it forms a hard coagulum which resists caries. Care and precaution should be exercised in its use. A rubber dam should be placed over the tooth whenever possible. A crystal of silver nitrate may be crushed on a slab and placed upon the carious dentin with a moist pledget of cotton. It may be precipitated with oil of cloves, and should not be placed in very deep cavities by itself. Ammoniated silver nitrate is an effective form of this remedy. It may be prepared as follows (directions from Dr. Endleman): 1. Make a saturated solution of silver nitrate in distilled water. 2. Let it stand over night and decant it. 3. Add 28 per cent of ammonium hydroxid. On the addition of 25 per cent solution of formaldehyd U. S. P., metallic silver is precipitated.

This solution can be bought already prepared as Howe's solution, and may be used as follows: 1. Apply the ammoniated, silver nitrate solution. 2. After about two or three minutes, place a drop of solution of formaldehyd U. S. P., or eugenol. Metallic silver is precipitated, which sterilizes the structure of the dentinal tubules.

In deciduous teeth, "acolite" inlays can often be used effectively in complex cavities if the patient is not able or willing to pay for gold, which, of course, would be preferable. With copper amalgam, it is almost impossible to build permanent contact points in deciduous teeth.

Perhaps the tooth most susceptible to caries and pulp trouble is the first permanent molar. Early caries in this tooth is serious, for if the caries should involve the pulp (and it is easily involved), the dentist has a problem as far as saving the tooth is concerned. It is practically impossible to place a good root-canal filling in this tooth before the ninth year, at which time the apex has generally attained its final form. Many serious consequences may result from caries of the first permanent molar, the chief of which is the ulti-

mate loss of the tooth and, frequently, subsequent malformation of the dental arches. The pulp of this tooth, especially before the ninth year, is exceedingly vascular, and the tooth-root foramina are large and numerous, thus affording a copious interchange of blood between the tooth and the body generally, which may increase the liability of systemic infection.

As this particular tooth presents a problem of more than ordinary significance to the dentist, we shall probably be justified in spending a few moments in the consideration of its preservation through proper treatment and filling.

The two principal things with which we are concerned in filling any tooth are the rehabilitation of its function and the prevention of further caries in the tooth.

The first permanent molar nearly always presents undecayed pits and fissures soon after its appearance in the arch. In my opinion, one of the greatest mistakes the average dentist makes in connection with this type of tooth is his policy of "watchful waiting." These pits and fissures are vulnerable places for the beginning of cavities, which are usually inevitable if such imperfections are allowed to remain unnoticed. Realizing this, is it not logical for us to treat them in such manner as to prevent the beginning of caries at least until a time when the tooth cavity may be prepared without endangering the extremely sensitive vascular pulp tissue?

There are various ways in which these undecayed pits and fissures may be treated. A good procedure is as follows: 1. Remove débris with stiff brush and needle-point explorer. 2. Dry out with alcohol. 3. Apply silver nitrate for three minutes. 4. Precipitate with solution of formaldehyd U. S. P., if quick precipitation is desired. 5. Wipe out with pledget of cotton. 6. Apply a good cement. Place the cement at marginal ridge of the tooth, and work it down into pits and fissures. 7. With fingers coated with cocoa butter, apply pressure to the cement. Of course, during the entire procedure the tooth should be kept perfectly dry by means of the rubber dam.

If decay in the first permanent molar has progressed so far that all of the remaining carious dentin cannot be removed without involving the pulp tissue, it should by all means be permitted to remain in the floor of the cavity. In such a tooth, after all the decayed dentin that it is possible to remove has been spooned out, the cavity should be dehydrated with a gentle stream of warm air, or alcohol, if the patient will permit. The cavity may then be saturated with eugenol or oil of cloves, which is sealed up in the tooth, set with cement and allowed to remain for about a week. This operation should be repeated two or three times, leaving the cavity sealed from three to five days each time. As eugenol and oil of cloves are only mildly antiseptic and not germicidal, silver nitrate finally should be applied (in warm solution). If the patient manifests pain during the application of the silver nitrate, it should be neutralized or immediately precipitated. After its final application, the tooth may then receive a eugenol-cement base, and a permanent filling material.

In this treatise on prevention of caries by posterior fillings, I have endeavored to stress particularly the dignity and importance of filling teeth; to call attention to the fact that insuffi-

cient consideration is paid to the problem of preventing recurrent or progressive decay in the seat of cavities under fillings, and, lastly, to deplore the fact that dentists often become so engrossed in the actual mechanics of restoration, that they do not accord to the living, delicate, vascular pulp tissue the attention which it most certainly demands.

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A NEW METHOD OF PLASTIC LENGTHENING OF THE MANDIBLE IN UNILATERAL MICROGENIA AND ASYMMETRY OF THE FACE*

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THE shortness of one side of the mandible is always attended by a marked asymmetry of the face and therefore is one of the most difficult deformities to correct. The depressed mental condition of the patient leads us to seek a satisfactory cosmetic result even if functionally the deformity is not very important. (Figs. 1, 2, 3 and 4.) The deformity is caused mostly by severe osteomyelitis, with necrosis of the bone, inflammation and ankylosis of the articulation, and injuries of the bone. The final shortening is due to the lack of tissue after necrosis and injury, or to the maldevelopment of the corresponding side. The progressive maldevelopment of the mandible changes the conditions of the occlusion and of the soft tissue pressure, and is the cause of the deformity's being transmitted to the corresponding upper jaw. The earlier in childhood the impediment in growth arises, the heavier is the deformity of both jaws and the asymmetry of the face.

The treatment consists of four parts: (1) orthodontic treatment; (2) surgical operations; (3) orthopedic treatment, and (4) prosthetic treatment. The aim of the orthodontic treatment is to obtain a functional and cosmetic conformity of the lower and upper dental arches. This can sometimes be done before and sometimes after the operation. In cases of unilateral microgenia, it is more advantageous to carry out the orthodontic treatment after the results of the surgical operation for the correction of the mandibular arch are well fixed. The operative method of treatment is resorted to only in cases of deformity, where conservative orthodontic treatment cannot be performed.

In cases of manifest unilateral microgenia, correction is impossible by orthodontic means alone. The unfitness of these methods lies in the deformity itself. Correction of the dental arches and alveolar processes without the elongation of the mandibular horizontal part cannot improve the contour of the face. The operation must afford radical correction of the mandible itself in its relation to the skull, as this is the only means of improving the shape of the

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Fig. 1 (Case 1).—Left: Appearance of patient before treatment. Center: Patient undergoing treatment. Right: Corrected case.

lower part of the face. The correction of the secondary deformity of the upper alveolar arch in its relation to the skull can, to a certain degree, be obtained by subsequent orthodontic treatment.

The operation must correct radically the form and position of the mandible and the contour of the lower portions of the face. The orthopedic treatment must, with the aid of different appliances, join the fragments or even improve their new position. This treatment must begin immediately after the operation, and is continued until the artificial fracture is entirely healed. The prosthetic treatment corrects the

Fig. 2 (Case 2).—Case of asymmetry before and after correction.

Fig. 3 (Case 3).—Case of asymmetry before and after correction.

defects which have arisen or have not been corrected by the preceding manipulations. (Fig. 5.)

We have met in literature a number of cases pointing out different methods of treating deformities of the lower jaw. In all of them, great risks have to be run before a favorable result can be obtained. An oblique osteotomy (Figs. 6 and 7) is the simplest method

Fig. 4 (Case 5).—Left: Case of asymmetry. Right: Patient undergoing treatment.

Fig. 5 (Case 2).—Case shown in Figure 2: prosthetic treatment.

Fig. 6.—Oblique osteotomy.

Fig. 7.—Oblique osteotomy.

of lengthening the mandible. We have used it with satisfactory results in cases in which the thickness of the mandibular bone was sufficient and in which the teeth afforded solid support for the fixation of the fragments. (Fig. 8.) A good contact has to be maintained at the ends of the fractured bone after they

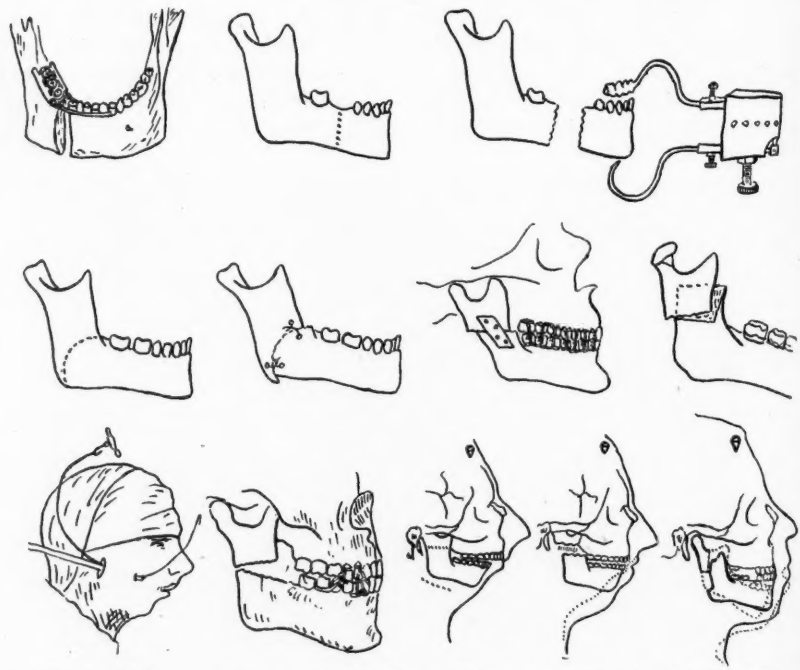

Fig. 8.—Oblique osteotomy, employed where sufficient support is afforded for fixation of the fragments.

have been slid into their new position. This necessitates a vertical transposition of the fragments which sometimes can be useful for the better occlusion of the teeth. As a rule, we never make use of wire sutures.

Two methods of employing osteotomy for lengthening the horizontal part of the mandible are possible. Eiselsberg, in 1906 (Fig. 9) and Pehr Gadd (Fig. 10) proposed to slip the fragments sidewise and horizontally without vertically displacing them. The ends of the fragments do not press together, but are fixed at their extremities by wire sutures; the essential defect of the method.

I have used this method for widening the front part of the mandible in a case of bilateral microgenia. The results of the operation were quite satisfactory; and the wound healed by first intention. The difficulty lay in the fixation of the fragments in position, and a part of the "hard-earned ground" was lost a few months after the operation, because of weak union of the fracture. (Fig. 11.)

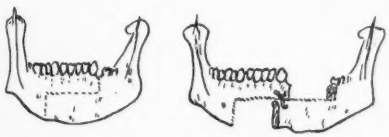

Fig. 9.—Osteotomy (Eiselsberg method).

Fig. 10.—Osteotomy (Pehr Gadd method).

In a second case, the fragments are, after the osteotomy, slipped apart and, after a vertical movement is made, the fragments are pressed against one another. This vertical movement is sometimes useful for teeth regulation, but is more often only an obstacle.

Fig. 11.—Osteotomy in which method illustrated in Figures 10 and 11 was employed. Results were not entirely satisfactory since ground was lost through weak union of the fractures.

Eiselsberg's second method is seen in Figure 12 and in Figure 13 (Nicolsky,[1] 1912). Both these authors recommend wire sutures, which are necessary to hold the extremities of the fragments in position.

Brown (1918)[2] (Fig. 8, upper left) and Bruhn-Lindemann (1921) (Fig. 8, upper, right center), recommend a

1. Nicolsky: Chir. Arch. Weljaminov, Vol. 4, 1912.

2. Brown: Oral Diseases and Malformations, 1918.

vertical osteotomy of the mandible with a simple pulling apart of the fragments. The ensuing defect, if small, fills up of itself with new bone. If it is big, bone transplantation is performed. There is no bony support between the

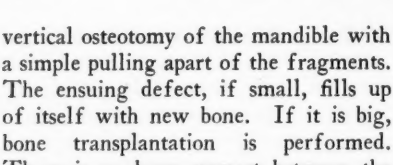

Fig. 12.—Osteotomy (Eiselsberg's second method).

first and second operation; which is a great handicap in the orthopedic treatment. This is clearly pointed out by the use of Bruhn's[3] massive appliance (Fig. 8, upper, right). An osteotomy with extension of the fragments is rarely performed without the mucosa being injured and the oral cavity broken into. Brown therefore proposes an intra-oral operation. An increased length of one half inch may thus be secured. The communication of the wound with the oral cavity makes an immediate bone transplantation impossible. Later bone grafting, especially after a lapse of several weeks, as recommended by Lindemann, is also very dangerous.

Cryer performs an operation by dividing the bone just anterior to the angle. (Fig. 8, center, left.) This method, like all osteotomies performed on the ascending ramus, is much more safe as far as infection from the oral cavity is concerned. It gives but a limited possibility for lengthening the mandibular body and can seldom be used for correction of microgenia. In Figure 8, lower, left, we see Blair's[4] method, (1920) and in Figure 8, middle, center, Lane's method (1916) of performing a horizontal osteotomy in the ascending rami.

I had two cases of ankylosis in which I operated, transposing the mandible (Fig. 8, lower, center). In both cases, a good result was obtained. There was a decided transposition of the chin and the asymmetry was not so marked. (Figs. 11 and 14.)

In a unilateral operation, the transposition of the mandible was obtained merely by the use of wire dental splints. In the other case, a bilateral osteotomy, I had to resort to an additional extra-oral traction. (Fig. 14, upper, right.)

A certain transposition of the mandibular arch forward can be obtained by my method of oblique osteotomy (Fig. 8, lower, right) and by Perthes-Schloessmann's method (Fig. 8, center, right). All the foregoing methods have more or less essential defects. The absence of bone fixation in the region of the divided fragments influences them to return to their previous position. Traction by dental wire splints

Fig. 13.—Osteotomy (Nicolsky and Bruhn-Lindemann).

and even by more complicated appliances (Bruhn) may not be sufficient to obtain a normal contour of the lower mandibular edge. Edentulous fragments are very difficult to fix. Bruhn's

3. Bruhn: Deutsch. Monatschr. f. Zahnheilk., No. 13, 1921.

4. Blair, V. P.: Surgery and Diseases of the Mouth and Jaws, 1920.

Fig. 14—Case of ankylosis. The improvement in the patient's appearance is shown by photographs and graph. Upper right: Method of employing additional extra-oral traction after a bilateral osteotomy.

method of bone fixation by a hook or wire suture is dangerous because of possible infection and partial necrosis. It is therefore rarely applied.

The choice of place for the unilateral operation is of the utmost importance. It depends on a number of factors. The relation between the upper and the lower teeth is to be carefully considered. Another requirement is to create the best possible form of the lower edge of the mandible, while the fragments are put in a new position. Therefore, all the operations on any part but the body of the mandible cannot give a satisfactory cosmetic result. The irregular curves of the horizontal part will remain uncorrected, and consequently will always be noticeable. The bringing forward of the bone will be but of slight importance (from 1 to 1.5 cm.). All splitting methods can be performed only on a mandible of normal thickness. In most cases of unilateral microgenia, the jaw is atrophied and its thickness will allow no splitting. This can be felt by a simple external examination. All the proposed methods of immediate free bone transplantation into the defect are not to be relied on. The osteotomy and the pulling asunder of the fragments can scarcely be performed without injuring and even tearing of the mucosa lining the region of the alveolar process.

Fig. 15.—Case in which immediate free bone graft afforded good consolidation.

We had cases of immediate free bone graft affording good consolidation, but the effect of lengthening the jaw was of small importance (Fig. 15). I had the occasion to observe a patient not operated on by me, in whom the splitting and extension were obtained without injuring the mucous membrane. However, the expanded gum is not much protection against the penetration of infection and often cracks on the

second or third day after the operation. In this particular case, there was soon suppuration, necessitating the extraction of the graft. As a result, the shortening remained as before. If a bone graft is employed in a second operation (at a second stage) after a sufficient interval, it causes many technical difficulties, on account of the necessity of having to operate in scar tissue.

I have the honor to present a new method for elongating the body of the mandible, which I had the occasion to verify in six cases of unilateral microgenia, in a girl of 13 years and women, 23, 25, 27 and 36 years of age. My principal aim was to join the advantages of free bone-grafting to an immediate filling of the defect after the osteotomy and extension of the fragments. The importance of filling the gap with living bone tissue is not only of great consequence for good bony consolidation, but also plays a serious part in fixing the fragments in their new position with maximum extension of the mandibular arch. By applying dental wire splints only, we cannot obtain a proportionally equal extension of the fragments. The teeth and the corresponding alveolar part have a tendency to decline in the direction of the traction, while the body and the edge of the mandible remain in a wrong position.

It is easy to create the material for such a bone stretcher if we divide the surgical treatment into two stages.

Fig. 16.—New method of elongating the body of the mandible: transplantation of rib. Compare Figures 17 and 18.

Fig. 17.—Second step in elongating operation: the rib is dissected away from the mandible with a chisel and a vertical osteotomy is performed.

(Fig. 16.) During the first operation, we transplant a rib, an inch and half (from 3 to 4 cm.) long, under the lower edge of the mandible in the region where, in the second stage, we propose to perform the osteotomy. The rib is taken with the exterior periosteum and is placed preferably under the periosteum of the mandibular bone.

The second operation is performed two or three months after the first. Local and conductive anesthesia with

procain is employed. An incision is made in the oral cavity on the gum and mucous membrane in the region of the proposed osteotomy. The hands of the operator undergo a second washing before the external operation. An incision is made on the external old scar, and the lower mandibular edge is uncovered. The rib is carefully dissected away from the mandible with a chisel, and remains hanging on the flap of soft tissue at the bottom of the wound. (Fig. 17.) A vertical or "steplike" osteotomy is then performed with the aid of a drill and osteotome. The fragments are forcibly pushed asunder by Heister's mouth gag to a distance of several centimeters. The alveolar arch and the mandible are set in an accurate position in relation to the skull. The superfluous ends of the rib are cut off and left at the bottom of the wound, and the rib stretcher is pushed between the extended mandibular fragments and

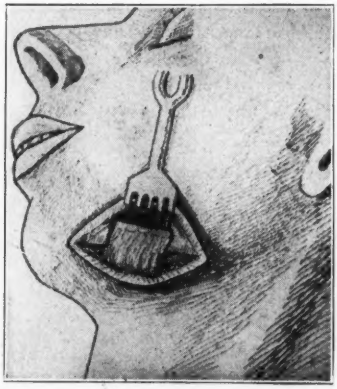

Fig. 18.—Third step in elongating operation.

Fig. 20 (Case 3).—Position of transplanted rib after operation under lower edge of mandible.

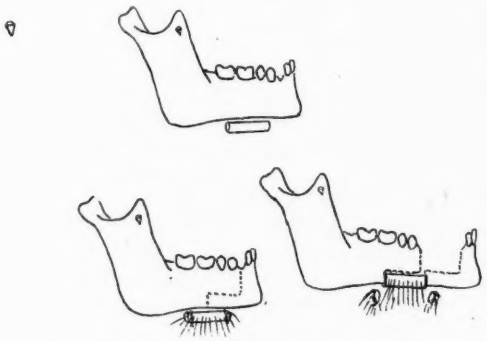

Fig. 19.—Case in which a steplike osteotomy permitted use of a pedunculated bone graft.

held in by them. The nourishing flap is well guarded from injury. (Fig. 18.) Catgut sutures are placed on the periosteum, and the skin is sutured with horsehair. The oral side of the wound is tightly packed with iodoform gauze, which is not removed for from eight to ten days.

In a case in which cosmetic considerations led us to select osteotomy as the

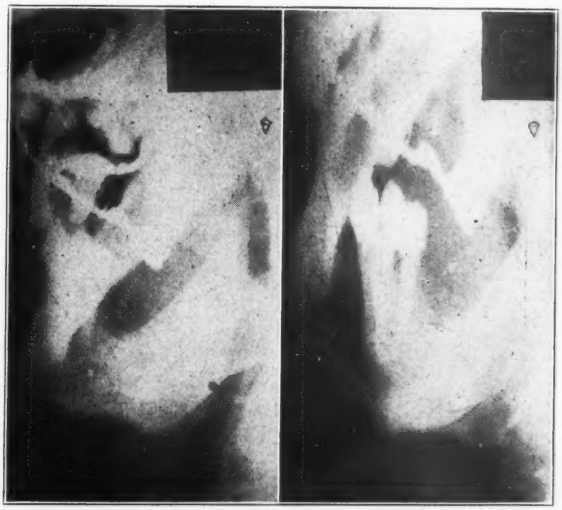

Fig. 21 (Case 3).—Position of transplanted rib; rib cleft held in by two fragments of mandible after second operation.

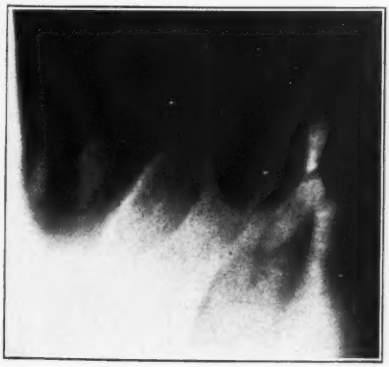

Fig. 22 (Case 5).—Position of transplanted rib.

Fig. 23.—Rib cleft held in by two fragments of mandible after second operation.

operation of choice, in the middle of the lower mandibular border, and the conditions of occlusion indicated cutting of the bone through the dental alveolus of the cuspid, we performed a steplike osteotomy, which allowed us to take advantage of the pedunculated bone graft as was the case in a vertical osteotomy. (Fig. 19.)

In all my cases, the external wound healed by first intention; the gap in the mouth between the fragments, by granulation. The packing was changed for the first time on the eighth or tenth day and for the following three to four weeks, every two or three days. In Figures 20, 21 and 22, Cases 3, 4 and 5, we can see the position of the transplanted rib after the first operation under the lower edge of the mandible. Figures 21, 23 and 24 show the rib cleft held in by the two fragments of the mandible after the second operation.

The shape of the mandibular arch and the contour of the face have greatly improved, as we may see in the photographs and masks taken before and after operation. (Figs. 1, 2, 3, 4, 25 and 26.) For the first operation, the patients remain in the hospital for about ten days; for the second, from two to three weeks.

REPORT OF CASES

CASE 1.—A girl, aged 13 years, had a left sided deformity after partial necrosis of the horizontal part of the mandible, a complication after typhus exanthematicus, five years previously (bone defect plus impediment in growth). There was a lapse of fifty-four days between the first and second operations. (Figs. 1, 27 and 28.)

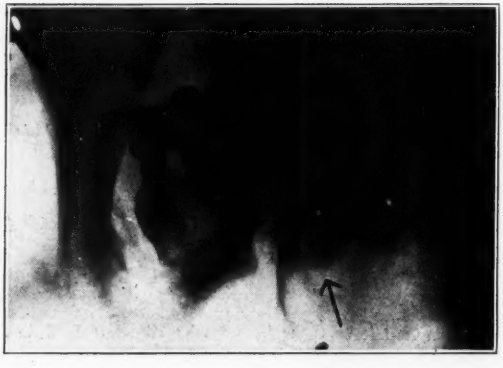

Fig. 24 (Case 5).—Rib cleft held in by two fragments of mandible after second operation.

CASE 2.—A woman, aged 27, suffered partial necrosis of the horizontal ramus, due to osteomyelitis at the age of 9 years. Six months and thirteen days intervened between the two operations. (Figs. 2 and 5.)

CASE 3.—A woman, aged 25, presented a microgenia on the right side after severe osteomyelitis at the age of 8 or 10 years, with partial necrosis. A space of two months and eleven days intervened between the operations. (Figs. 3, 20, 29, 30, 31 and 32.)

CASE 4.—A woman, aged 25, suffered deformity and ankylosis after a difficult birth. There was an interval of three months and thirteen days between operations. (Figs. 21, 25, 26, 33, 34, 35 and 36.) Insufficient mobility of the left articulation necessitated

a third operation, involving resection of the condyloid process with an interposition of free grafted soft tissue. The patient now has no difficulty in opening her mouth and, in doing so, the chin has no tendency to deviate to the afflicted side. (Fig. 33.)

CASE 5.—(Figs. 4, 22, 24, 37, 38, 39, 40, 41, 42 and 43.) A woman, aged 36, had pronounced left microgenia from childhood. An interval of eight months intervened between the operations. The rib, when dissected from the mandible, lost nearly all contact with the soft tissues. The capsule which surrounded the piece of the rib was easily separated from it. The graft was left hanging on a thin flap consisting of scar tissue no wider than 3 mm. and certainly not important enough to carry a sufficient blood supply The flap seemed to be the remains of the scar after a suppuration following the first operation. The suppuration lasted for several weeks, at the end of which a ligature and a small sequestrum of the anterior portion of the graft came out. Shortly thereafter, the wound closed.

Fig. 25 (Case 4).—Mask showing improvement after operation.

From the foregoing, we see that the graft was deprived of all blood supply. Notwithstanding, a steplike osteotomy was performed in the usual way. The fragments were drawn asunder and the small graft inserted between them. (Figs. 22, 24 and 40.) It was then covered with soft tissue and sutured with catgut. Horsehair sutures were used on the skin. An incision was made on the mucosa of the oral cavity over the area of operation at first. The large gap that resulted was packed with iodoform gauze. On the eleventh day, by a small incision on the scar, a hematoma containing pus was excised. In spite of this, the wound healed by first intention. During the operation, this case seemed to be the least successful, but the end-results were the same.

This case gave us the opportunity to study more carefully the principles of free grafting. We doubted our surmise as to the importance of the blood supply through the pedicle of soft tissue. Perhaps the successful issue of the second operation depended chiefly on the stimulative action of the bone graft (which lies under the lower mandibular edge for two or three months) and the

Fig. 26 (Case 4).—Appearance of patient after treatment.

osteogenetic agents of the adjacent periosteum and soft tissues. At the moment of the second operation, the capacity of the graft to heal and to undergo biologic changes is at its height. Therefore, the graft, in spite of its partial denudation, healed without any complications. Firm consolidation of the mandibular fragments with the graft, wedged between them, sets in very soon. Besides the osteogenetic properties of the tissues, the nature of the graft itself is of importance. At the moment of the second operation, it is at the period of a more or less progressive decalcification. It is softer and more porous than normal bone and therefore its healing in is quicker. It is more easily impregnated by blood plasma and the blood vessels of the granulating tissue have less difficulty in entering it.

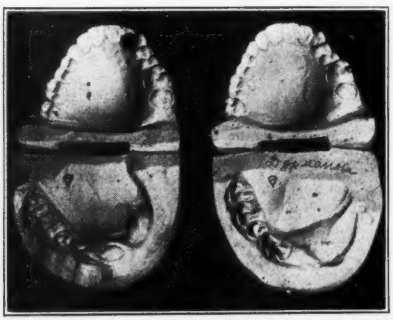

Fig. 27 (Case 1).—Casts of case.

Fig. 28 (Case 1).—Casts of case.

CASE 6.—A woman, aged 23, showed asymmetry of the face as a result of a gunshot wound that caused a shortening of the left side of the mandible. There was an interval of seventy-one days between the two operations.

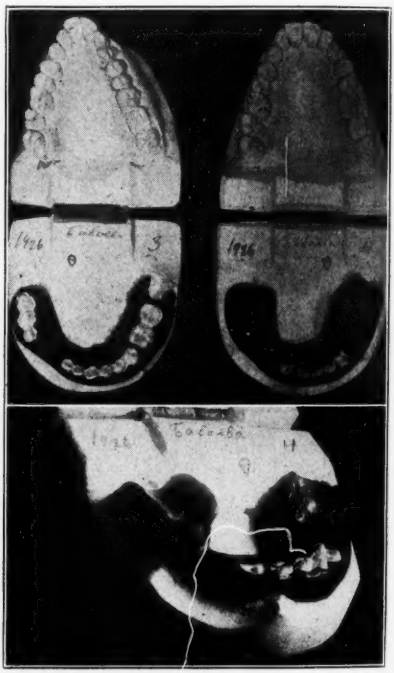

Fig. 29 (Case 3).—Casts of case before and after operation.

To correct the uneven contour of the edges of the mandible which sometimes remains after the osteotomy, we use small cartilage grafts. These grafts are taken at the moment of the first operation and are placed in the subcutaneous tissue of the breast wound in its upper part. Such grafts were maintained in the subcutaneous tissue of

the breast of the patients in Cases 3 and 4 for thirteen and fifteen months. They were then transplanted under the periosteum of the lower mandibular edge to raise the face. Both the stored up grafts consisted of bone and cartilage. It is interesting to note that, in both cases, the part of the graft consisting of bone had transformed itself

Fig. 30 (Case 3).—Graph of case.

into a thin spear-shaped point, while the cartilage had remained unchanged and quite fit for the purpose of support (Fig. 34). When cut, the cartilage showed somewhere calcification areas. We consider that bone grafts can be used only in cases in which functional forces are present. For cosmetic purposes, cartilage is the best material (without its perichondrium).

The consolidation of the fracture and the correction of the occlusion is as follows: We make a cut corresponding

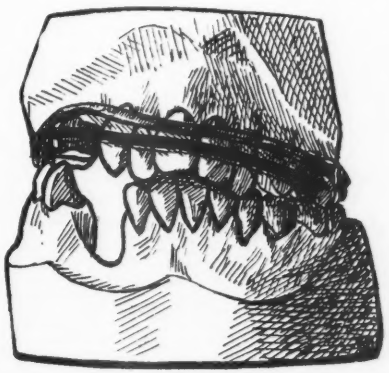

Fig. 32 (Case 3).—Orthodontic treatment of case.

to the site and shape of the bone, through plaster models, and place the fragments in the new occlusion. (Figs.

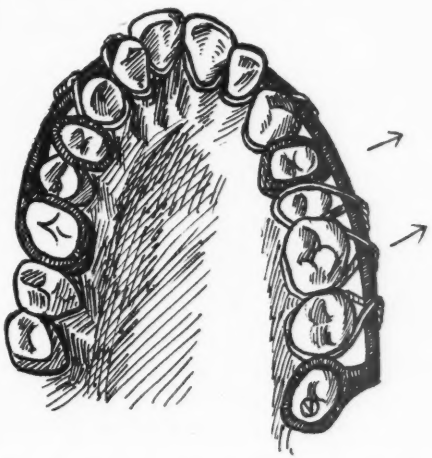

Fig. 31 (Case 3).—Orthodontic treatment of case.

38, 44 and 45.) An orthopedic wire splint with hooks, for intermaxillary fixation by India rubber rings, is prepared. Special wire hoops are made on the maxillary splint for the support of the lower teeth in the parts where they do not occlude with the upper ones. To reinforce the traction to one side, the upper splint is supplied with an accessory wire over which are placed the rubber rings. (Figs. 4 and 35.) The splints are fixed in place by ribbon band rings and bronze aluminum wire ligatures. In one of our cases, we had to reinforce this appliance by extra-oral

Fig. 33 (Case 4).—Appearance of patient after operation, showing ability to open mouth and improvement in symmetry of face.

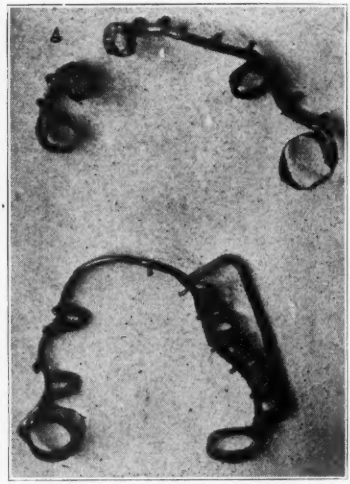

Fig. 35 (Case 4).—Splints.

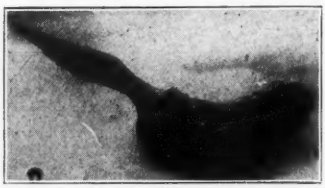

Fig. 34 (Case 4).—Graft which was stored before needed in subcutaneous tissue of the breast. The bone had become spear-like, but the cartilage was unchanged.

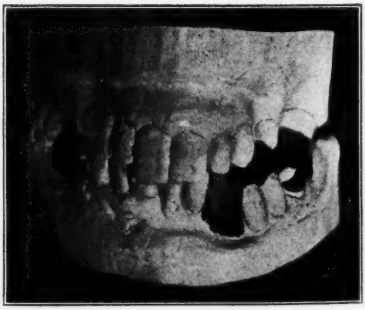

Fig. 36 (Case 4).—Cast showing restoration.

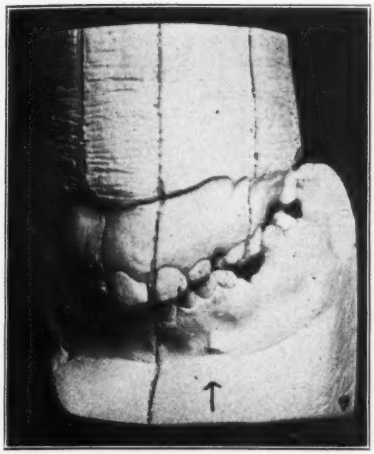

Fig. 37 (Case 5).—Cast made before operation.

Fig. 38 (Case 5).—Cast showing extent of operation.

traction. Figure 1, center, shows a weight thrown over a block.

A complete intra-oral immobilization of the fragments has to be maintained for from four to six weeks, after which a vulcanite splint (in the type of Weber or with a gliding surface) is applied (Fig. 29), until a complete consolidation is obtained. Two or three months is the average time, after which one can begin with orthodontic treatment. It is performed in the usual way with the aid of springing arches and is adequate to each case. (Figs. 32 and 41.)

We can see on the plaster casts the occlusion before and after the treat-

Fig. 39 (Case 5).—Casts of upper and lower jaw.

ment. We have to transpose the lower teeth to an external occlusion against the upper teeth, which have suffered from a secondary deformation. (Figs. 4, 28, 38 and 44.) The bone graft acts as a stretcher in the lower portion of the mandible. It thereby helps the teeth to assume their normal vertical position, which was interfered with by the shortening of the mandibular arch. (Case 1, Fig. 27.)

Satisfactory lower dental arches are seen on all the models. Case 3 (Fig. 29) shows how important the

Fig. 40 (Case 5).—Roentgenographic appearance of jaw.

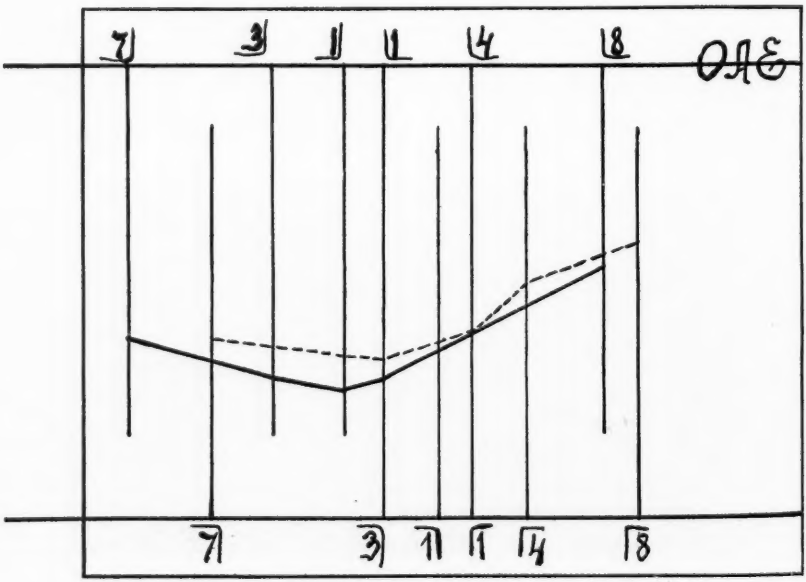

Fig. 41 (Case 5).—Graph showing alteration in position of teeth.

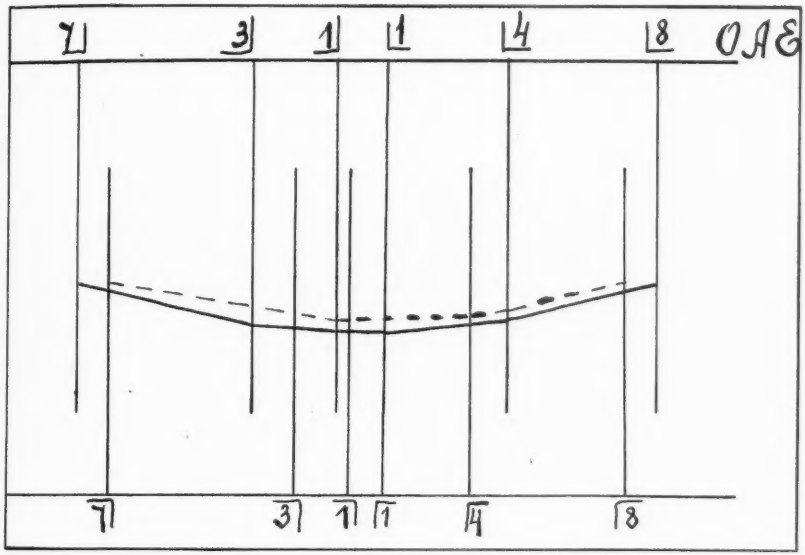

Fig. 42 (Case 5).—Graph showing alteration in position of teeth.

Fig. 43 (Case 5).—Graph of lower jaw.

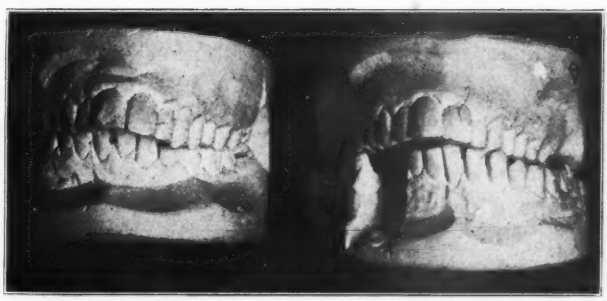

Fig. 44.—Cast showing extent of operation.

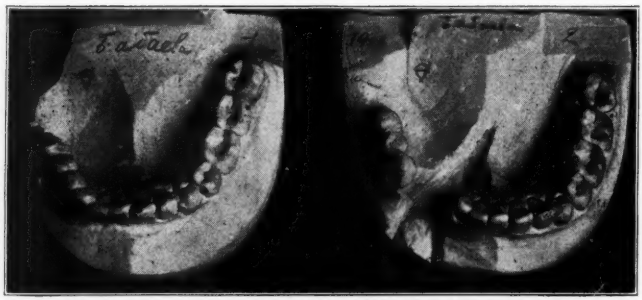

Fig. 45.—Cast showing operation.

secondary deformation of the upper dental arch can be. This latter deformity makes the orthodontic treatment extremely difficult. A marked improvement of the upper dental arch is seen in Case 3. (Figs. 29, 31, 32 and 46.)

CONCLUSIONS

1. In cases of plastic bone operation on the mandible for correction of unilateral microgenia, better cosmetic results are obtained by fixing the fragments in the region of the lower mandibular edge by a bone graft, which acts as a stretcher. A bone fixation is even more necessary in fragments in which the teeth are missing. The graft does not only purpose to push asunder the alveolar portion of the mandible: it also assures a good position to the mandibular fragments in the region of its lower edge, establishing them in a satisfactory vertical direction.

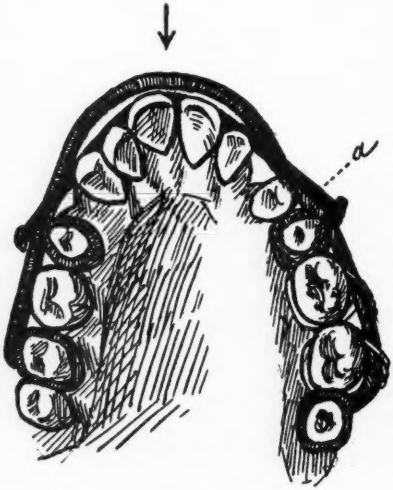

Fig. 46.—Orthodontic treatment.

2. A bone bridge between the fragments guarantees a primary and solid bone consolidation of the fracture, which is indispensable in cases of plastic lengthening of the mandible. The portion of mandibular periosteum attached to the graft remains with it between the mandibular fragments and improves the conditions for the formation of a good bony consolidation.

3. During the first operation, a piece of rib 4 or 5 cm. long is transplanted under the lower mandibular edge. The second operation takes place two or three months later. The graft is dissected from the mandible and is left hanging on a wide flap of soft tissue. A vertical or steplike osteotomy is then performed on the mandible. The fragments are drawn asunder and the

graft is pushed in between them. Both ends of the graft are freshened. The outer wound is sutured. The gap between the fragments in the mouth cavity is tightly packed with iodoform gauze.

4. The graft stimulates the osteogenetic properties of the surrounding tissues and prepares them for osteotomy. The graft in itself undergoes various changes. All this greatly contributes toward its healing in, notwithstanding the other, unfavorable conditions.

5. As the moving asunder of the fragments makes the rupture of the mucous membrane inevitable, it is necessary to perform an incision on the gums at the right place at the very beginning of the operation.

6. This new method excludes the possibility of severe oral infection and gives a solid bone graft bridge fixation. It excludes the necessity of wiring the bone of the fragments, which we, as a rule, never do.

INTRA-ARTICULAR BONY ANKYLOSIS OF THE TEMPOROMANDIBULAR ARTICULATION*

By JAMES O. BEAVIS, D.D.S., M.S., Ann Arbor, Michigan

IN order to discuss the subject of temporomandibular ankylosis in such a way that it may be thoroughly appreciated and its fundamentals be understood, it is first necessary to give it a classification which is as simple as possible, and yet present its pathologic anatomy in its entirety. This has already been done for us by Murphy as follows: (*a*) intra-articular bony ankylosis; (*b*) intra-articular fibrous ankylosis; (*c*) subzygomatic cicatricial fixations, and (*d*) intra-alveolar buccal fixations.

As the majority of operative cases at the University Hospital at Ann Arbor have been classified as intra-articular bony ankyloses, the substance of this paper will deal with this lesion.

In order to realize more fully the changes taking place in the temporomandibular joint which lead to this specific type of disease, it is, I believe, worth while to consider something of the embryology of the joint and the structures which make it up.

Joints are grossly classified as follows: (1) synarthroses or immovable articulations; (2) amphiarthroses or slightly movable articulations, and (3) diarthrosis or freely movable articulations. Under the head of diarthroses comes the subdivision ginglymus or hinge joint; therefore, the temporomandibular articulation may be classed as a ginglymo-arthrodial joint or a hinge joint having, in addition to its hinge motion, one of the gliding character, as is evidenced by the excursion of the head of the condyles independently or together over the eminentia articularis.

Primarily, joints all undergo the same embryologic changes before they

*Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 26, 1927.

take on their characteristic structure. In the beginning, the joint is represented by an intermediate substance interposed between cartilaginous skeletal elements which later become bones proper. This intermediate substance is gradually transformed into cartilage, and no traces of the interposed connective tissue is left. The two terminal cartilaginous surfaces of the two skeletal organs are found then in immediate contact. Soon, there is a small slit which seems to bisect the terminal cartilaginous surfaces, giving two, which are applied against the terminal surfaces of the cartilaginous skeletal parts and constitute the articular cartilages. Later, the slit becomes more extensive and constitutes the joint cavity. The outside of the joint cavity is limited by connective tissue, which is continuous with the periosteum or perichondrium of the two developing bones, and it is this connective tissue that gives rise to the capsule of the joint. The outside layers of the connective tissue become differentiated into a fibrous membrane and form the capsular ligament, while those of the inner side toward the joint are transformed into a softer and more highly vascular membrane and constitute the synovial membrane. The fibers of the capsular ligament again differentiate and may become thin in some parts of the capsule; while, in others, the capsule is thickened and may even form bands of fibers which become separated from the capsular ligament to form the auxiliary ligaments.

In the formation of the temporomaxillary joint, the process is essentially the same as just described, but instead of the one primary slit appearing to form the future joint cavity, there are two that appear, between which is interposed intermediate substance, which is later differentiated into an interarticular disk. The reason for this type of joint formation is that the two articular surfaces are more or less discordant, leaving more intermediate substance intact, which later becomes interarticular cartilage. Gegenbaur[1] states that the characteristic feature and disposition of joint surfaces are intrinsic and determined before the joint can function, and that the final transformation, as the extension of the joint cavity, occurs only after the joint is put into use, which is determined by skeletal movements and by muscular action. Bernay[2] states that the early and typical form of joints appears to be a matter of heredity, and that the muscles have a decided influence on the later forms of articular surfaces. Fick[3] has shown that muscular activity is responsible for the peculiar form of different articular surfaces. Experimenting on young dogs, he noticed that the sectioning of the muscles is followed by a change in the form of the corresponding articular surfaces and also of the articular space.

When we think of the forces, such as muscle strain and skeletal traction, which so markedly influences joint structure, the next question which should enter our minds concerns the structural changes of the joint and its associated structures when it has been completely immobilized over a considerable period of time, and what factors

1. Gegenbaur: The Morphology of the Joints of Vertebrates, Morphology, Vol. 2, 1876.

2. Bernay, A.: The Development of the Knee Joints of Men and Observations on the Articulation in Lower Animals, Morphol. Jahrb., 4: 403-446, 1878.

3. Fick, L.: Origin of the Shapes of Bones, 1857.

we can rationally expect to be instrumental in causing such a condition.

Before discussing the causative agents in this lesion, let us briefly review the anatomy and physiology of the fully formed joint. In the temporomandibular articulation,[4] the socket is formed partly by the anterior part of the mandibular fossa of the temporal bone and the articular tubercle above, in which rests the condyle of the mandible below. Interposed between the fossa and the head of the condyle is the articular disk, made up of fibrocartilage. These structures are surrounded by the capsular ligament which forms a thin loose envelop attached above to the mandibular fossa at its circumference and the articular tubercle immediately in front, and below, to the neck of the condyle of the mandible. The remaining accessory ligaments make up the rest of the articulation. The two[4] temporomandibular articulations act simultaneously and are capable of two kinds of motion. First, when the mouth is opened, the head of the condyle, with the interarticular disk, glides forward on the articular eminence, and when the mouth is closed, it slips back into the mandibular fossa. Its second type of motion regards the lateral displacement of the mandible in reference to the skull. Both hinge and lateral movements are used in mastication.

Etiologic factors in reference to intra-osseous ankylosis of the temporomandibular articulation have been treated to some extent by the literature. They should, I believe, be considered in regard, first, to the position of the articulation, and, secondly, to the age of the individual in which the lesion is most commonly found. Blair[5] stated that the age at which ankylosis became established varied greatly, but was generally under 10 years. The observations at the University Hospital show that the predisposing age is from 1 to 10 years.

Owing to the fact that the articulation is found in close proximity to the middle ear and that, in subacute and chronic otitis media, pus has but to break through anteriorly into the glenoid cavity and thus, secondarily, infect the joint, otitis media, which is predominant in childhood, plays one of the most important rôles in this affection. This may act as a mandibular osteitis, or osteomyelitis extending from the middle ear. Murphy and Kreuscher[6] report three of their series as a result of otitis media, and our observations show two cases due to the same cause.

In considering the age incidence, the acute exanthemata have to be considered and, indeed, a number of cases have been reported as a sequel to scarlet fever, although these are in the minority. In the more severe types of these, there is destruction of the synovial membrane and cartilage without much involvement of the periarticular tissues. The literature speaks of gonorrhea as a contributing factor, but I believe the consensus of opinion is that, owing to the age incidence of this lesion, the question of urethral infection would not play much part in its causation.

By far the most outstanding direct or indirect factor in osseous ankylosis of the temporomandibular articulation

4. Gray's Anatomy.

5. Lyons, C. J.: Ankylosis of the Jaw, J.A.M.A., Jan. 20, 1917.

6. Murphy, J. B., and Kreuscher, P. H.: Ankylosis of the Jaw, Dent. Cosmos, 58: 160 (Feb.) 1916.

is trauma to the mandible, usually at the symphysis. Owing to the fact that the lesion is incipient in its development and that the parents of the patient naturally do not observe intelligently the on-coming symptoms, it is oftentimes extremely difficult to get the history of the present illness in a form that means much to the clinician, and only by persistent questioning is the chronology of the process brought out. In about 75 per cent of our cases, we find a history of clear-cut trauma followed by the subjective symptoms which are so characteristic of this lesion.

We have observed no cases that have been the result of tuberculosis. Clinical and serologic evidence of a Koch infection in our series of cases has been negative.

DaCosta[7] mentions arthritis deformans as one of the etiologic factors in intra-osseous ankylosis of the temporomandibular articulation. We have not had occasion to observe a case of this type.

In considering the histopathology of the joint, I do not believe one can absolutely limit the disease process to the intracapsular or extracapsular variety; for the probabilities are that the process does not limit itself to the intracapsular structures alone, but, on the other hand, the capsule itself may also be involved. It is fallacy to think that a chronic suppurative otitis media which has broken into the joint anteriorly will confine its involvement to the synovial membrane and cartilages. On the other hand, it will most probably involve the capsule and pericapsular structures also. In the same way, I do not believe that hematogenous sepsis from distant foci will limit its action to the intracapsular structures alone, although it may produce a specific intra-articular bony ankylosis of the joint. The majority of the pathologic changes probably take place inside the capsule, but there are also some changes without. On exposing a joint which has undergone intra-articular bony ankylosis, there are few instances in which pericapsular disease of more or less severity has not been found.

Let us consider what additional factors may come into play in the slow, ever-progressing process, which eventually ends in an osseous ankylosis. First of all, what is the incidence of this lesion? Immediately, it occurs to us that it is a relatively rare type of disease when it is limited to the temporomandibular articulation; that is, we may say that many children between the ages of 1 and 10 years, which is its most prevalent age incidence, may be struck with considerable violence on the point of the chin and not suffer osseous ankylosis, while there are a certain few who will. Is it possible that the blow which they receive may be more violent, or do they possess an intrinsic susceptibility to react in a much more marked manner to trauma which, in other individuals, would cause no such reaction; this marked reaction manifesting itself first as a fibrous and then as an osseous ankylosis of the joint? A susceptibility of this kind could be inherited the same as susceptibility to any other types of acquired pathologic change. Secondly, we must not forget that all the tissue in the joint is of mesoblastic origin and is capable of metaplastic changes, either progressive or retrogressive. Thirdly, it must be kept in mind that, whether the etiologic factor is traumatic or infectious, the end-result will be the same;

7. DaCosta: Modern Surgery, W. B. Saunders Company.

namely, an intra-articular osseous ankylosis. In those cases in which the initiating factor has been trauma, ankylosis is usually brought about by the proliferation of fibrous tissue into and around the region of injury. Should the intra-articular cartilages be preserved in whole or in part, they sometimes undergo direct metaplasia into fibrous tissue or fibrocartilage, or into mucinous tissue, which gradually becomes fibrous. In some cases, the newly formed fibrous tissue is trifling in amount and the ankylosis is caused mainly by the presence of cartilage or bone. In other cases, the ankylosis is due to the presence of fibrous tissue or cartilage and bone. In still other cases, the ankylosis is due to the presence of fibrous tissue or cartilage and bone intermingled.[8] Thus, when the factor of irritation is brought in, we see the mesoblastic structures of the joint react to a marked degree, which always ends in the same type of pathologic change.

When an infection[5] is the predominating etiologic factor, a synovitis with effusion into the joint cavity results. The joint synovium becomes thickened in the early stages, while the surface of the cartilage is rough and fibrillated. Most observers believe that the degeneration of the cartilage is brought about because of some interference with nutrition, or is produced by the extension of the exudate which destroys the cartilage. In the early stages, not all of the cartilage may be destroyed, but there may remain islets of cartilage throughout the articulating surfaces. In this fashion, cartilages are gradually transformed into vascular, fibrous or fibro-osseous tissue. The joint cavity is traversed by dense fibrous bands and is converted into a number of small spaces bounded by dense fibrous tissue, the spaces containing synovial fluid. In the more advanced stages, the whole of the articular cartilage may disappear and be replaced by fibrous tissue, so that the original structure of the joint becomes almost unrecognizable. Secondary changes take place in the newly formed fibrous tissue, and, in time, it is converted into a mass of spongy bone, complete osseous ankylosis resulting. Again, this series of changes shows us that, in an inflammatory condition of the temporomandibular articulation, either from trauma or infection, there is a marked metaplasia, either progressive or retrogressive, with a resultant obliteration of the normal structure of the joint, and new structures remaining.

The diagnosis of intra-articular osseous ankylosis should not be looked on lightly, as surgical interference depends largely on the diagnosis rendered. It should not be until we are positive of the pathologic process existing in and around the joint that the type of surgical procedure to be used should be determined. In cases in which the etiologic factor has developed relatively early in the patient's life, the history will reveal an accident associated with some trauma about the jaws, usually to the symphysis. The pain coexisting with the trauma may or may not be extreme, and the patient or the parents associate nothing with the accident until some time later, when it is noticed that the jaws cannot be opened, and it has been our experience that it is not until complete immobility of the jaws is noticed that the patient is brought to a clinic for relief. Other cases will present a typical history of chronic otitis

8. Adami and Nicholls: Principles of Pathology.

media or one of the acute exanthemata which may lead to this affection.

As this type of pathologic change is dependent on the causative factors mentioned, a chronologic history of events concerning the lesion is invaluable to the diagnostician.

On physical examination, there are certain predominant signs which are, in most cases, pathognomonic of this type of joint disease. In the majority of cases there will be a flattening of the facial contour on the unaffected side, so that the observer may at first be led astray as to the position of the lesion. The affected side will bear the characteristics of normal facial contour. The cause of this deformity is explained by the fact that the condyle of the affected side is immobile and that, owing to muscle stress, the movable condyle is drawn slightly anteriorly, displacing the symphysis of the mandible from the midline over toward the ankylosed side, leaving the side of the face on which there is no ankylosis flattened.

On examining the profile of the patient, a marked aganthia is noticed, and the older the lesion, the more marked will be the deformity; for the muscle stress so necessary to bone development has been absent, with the inevitable result—a hypoplastic mandible. In the majority of cases, by palpating the head of the condyle on the unaffected side, on muscular activity, there will be noticed some motion, while its fellow on the opposite side will be perfectly immobile. This procedure, in many instances, helps in the diagnosis. Some observers state that the muscles on the ankylosed side are more atrophied than those on the unaffected side, while others report that, although disuse had been present for sometime in their cases, the amount of atrophy was relatively slight. In the cases observed at the University Hospital, muscular atrophy has not been so marked, considering the length of time the jaws have been immobile.

Murphy[6] states that, on measuring the distance from the lower edge of the zygomatic arch to the lower portion of the ramus of the jaw, it is found to be less on the affected side than on the unaffected side. This is particularly true if the lesion has occurred early in life, as the epiphysis of the condyle is the only means the ramus has of lengthening, and this growth is arrested by the calcification of the epiphyseal line before the normal time of ossification, which is the fifteenth year.

The lesion with which intra-articular osseous ankylosis is sometimes diagnostically confused is fibrous ankylosis. The use of the roentgen ray for a possible differentiation of these two lesions is indeed questionable, as the shadow cast by the changed structure of the articulation has no characteristic architecture that would allow one to make conclusive statements regarding the pathologic process concerned.

In fibrous ankylosis, although the adhesions may be numerous and the joint well bound down, there is usually some movement of the jaws, especially in a lateral direction, while the only movement elicited in intra-articular bony ankylosis is that which is very slight and due exclusively to the resiliency of the substance of the jaw. This simple procedure will, in many instances, decide the nature of the pathologic process.

Temporomaxillary ankylosis was the first condition to direct the surgeons' attention to the necessity for arthroplastic interference. The plan was first suggested by Verneuil,[9] in 1860.

9. Arch. Med., 1860.

He cured temporomaxillary ankylosis by the interposition of temporal muscle and fascia. Helferick, in 1893, mobilized the temporomaxillary joint by the insertion of a flap from the temporal muscle. This was repeated by Lentz, Henle and others. Mikulicz, in 1895, used a flap from the masseter muscle. Rocket and Schnüdt with Glück, in 1902, used a skin flap and had previously employed ivory joints to take the place of the excised structures. Very satisfactory results have been obtained by Brophy[10] by removing a crescentic shaped section of bone from the region of the angle of the jaw. Guttapercha is placed between the ends of the bones, which prevents the freshened ends from uniting. After six weeks, the guttapercha is removed. During the time that the guttapercha is intact, tissue, which may be similar to a hygroma bursa, is formed.

The treatment of intra-articular osseous ankylosis calls for surgical intervention. Forcibly separating the jaws will avail nothing. The procedure followed by the department of oral surgery at the University Hospital is that used for many years by John B. Murphy, probably one of the keenest clinical and experimental observers in the field of arthroplasty. The ankylosed joint is exposed, first, by a perpendicular incision in front of the ear extending from 2 cm. above the zygoma in the hair line downward to the lower border of the zygoma. This incision curves forward on the superior margin of the zygoma for a distance of about 2 cm. and then curves upward slightly to avoid injuring the temporal and orbital branches of the facial nerve. The incision leaves a slight scar, most of it being hidden in the hair, and gives very good access to the joint. The tissue covering the joint is pushed away until the bone is laid bare. As little trauma as possible should be associated with this procedure, in order not to injure the temporal and orbital branches of the facial nerve any more than is absolutely necessary.

After the neck of the condyle has been exposed as fully as possible, a full curved aneurysm needle is used for the purpose of guiding a steel ribbon, three one-thousandths inch in thickness and 1 cm. in width, under the condyloid neck. Instead of the ribbon, Murphy's curved periosteotomes may be used, being inserted one anteriorly and one posteriorly, to include the substance of the neck of the condyle. Both of these devices are used to protect the internal maxillary artery from trauma of any sort and also to keep the field easily accessible for the operator to work in. For removing the bone, different instruments have been recommended, which are as follows: the Gigli saw, bone burs of different descriptions and Rongeur forceps. The use of the mastoid chisel has proved to be very satisfactory, and we have found no occasion to make a substitution for it.

It is well to remember that at least one-half inch of bone should be removed to assure a functional result. Failures have been reported which have been due to nothing else than merely bisecting the neck of the condyle instead of removing at least 1 cm. of its bone, including the periosteum. After the segment of bone has been removed, the mouth can easily be opened by the anesthetist, and a U-shaped flap of fat and fascia is elevated from over the

10. Brophy, T. W.: Oral Surgery: The Diseases, Injuries and Malformations of the Mouth and Associated Parts, Philadelphia: P. Blakiston's Son and Company.

temporal muscle about 2 cm. wide and 4 cm. long, leaving the base attached at the upper margin of the zygoma. The flap is folded down over the zygoma and is packed into the bony gap left by the removal of the section of bone. The flap is immobilized as nearly as possible by catgut sutures anteriorly and posteriorly at the base of the flap over the zygoma. The wound is now closed by the approximation of the skin flap and sutured with horsehair. After the wound is cleaned thoroughly, a dry dressing with collodion superimposed may be applied.

Postoperative treatment of intra-articular bony ankylosis is of extreme importance, and in many cases determines the functional outcome. In order to understand what our aim really should be in regard to the possible changes taking place at the site of operative interference, let us return to the embryology of joint formation. Langemak[11] states that fat tissue rapidly and easily changes into connective tissue and that bursa formation is due to the absorption of fat from fatty tissue which gradually goes through metaplastic changes to form connective tissue. This connective tissue, in turn, when subjected to physical forces, such as pressure and strain, partly undergoes degenerative changes with the development of its basic organic substance, collagen. It is the liquefaction of the collagen in the center that forms the fluid in the cavity of the already formed bursa. The cells lining the newly developed cavity appear as flattened endothelial cells, but are, in reality, transformed connective tissue cells. To the result of these metaplastic and degenerative processes, the name hygroma bursa has been given. Murphy[12] states that, in the artificial development of joints, it is important to utilize these facts. The aponeurosis that is to be used in the construction of artificial joints should have in it a considerable quantity of fatty tissue, which, when subjected to pressure, forms the hygroma. So, in postoperative procedure, we should see that the flap which has been interposed does not necrose from too much pressure, which inhibits its blood supply. On the other hand, sufficient pressure should be exerted to promote hygroma formation. We have procured the best results by leaving the jaws relatively immobile for five days after operation and then gradually opening them, day by day, until their maximum separation is reached, which is usually about 2 cm. between the opposing cuspid teeth. The jaws are stretched to this capacity by a mouth gag at least three or four times each day, the gag being left in approximately five minutes each time. This treatment should be continued while the patient is in the hospital and for weeks, or even months, after the patient returns home. Properly instructed conscientious parents usually see that this is kept up. Patients who are old enough to carry out the procedure themselves should be properly instructed in doing so. There are a few precautions that should be taken by the surgeon in operative interference about the temporomandibular articulation. In dissecting down to the joint, it is imperative not to resect those branches of the facial nerve that travel through the site of operation, and the greatest care should be exercised not to traumatize these branches any more than is necessary.

11. Langemak: Arch. Klin. Chir., Vol. 70, No. 4, p. 946.

12. Murphy, J. B.: Arthroplasty—Clinical and Experimental, J.A.M.A., 44 (May 20) 1905.

The procedure, when properly executed, cannot give more than a temporary edema of the nerve filaments, which soon recover and resume their normal function. The possibility of injuring the internal maxillary artery enough to cause hemorrhage has been minimized by the use of the steel band medial to the neck of the condyle, or of the periosteotomes used by Murphy, which act toward the same end. The literature reports but few cases of severe hemorrhage due to traumatization of the internal maxillary artery.

Among the postoperative complications that have to be considered in this type of operation, capillary hemorrhage has had an important rôle. If this should occur and a hematoma manifest itself, the latter should be aspirated with a small caliber hypodermic needle as soon as possible. Aspirating should be continued until the tumor fails to reappear. This procedure is of the greatest importance, as a clot in the region of the resected bone offers a fine pabulum for fibroblastic and angioblastic proliferation, with a resulting fibrous union of the bone segments instead of the hygroma formation that is the object of our operative procedure. Infection complicating this type of operation should not occur to any marked degree if the site of interference is prepared properly, aseptic surgical technic is instituted and postoperative dressings are applied in such a way as to ward off infective agents.

CONCLUSIONS

1. Intra-articular bony ankylosis of the temporomandibular articulation is but one type of disease involving that joint.

2. The predisposing age for the lesion to appear is between 1 and 10 years.

3. In our experience, trauma as an etiologic factor plays a greater part than does infection.

4. This lesion entails specific surgical procedure; hence, an accurate diagnosis is invaluable.

5. The temporal fascia and fat flap is necessary for hygroma formation.

6. The failure or success of the operation depends to a great extent on postoperative manipulation and care.

DISCUSSION

Herbert A. Potts, Chicago, Ill.: This paper discusses clearly intra-articular ankylosis in a logical way, reviewing the etiology, embryology, physiology, pathology, diagnosis, treatment and prognosis. The proper treatment of the case in hand depends on an accurate diagnosis. The author has thoroughly covered the ground pertaining to the intra-articular ankylosis, but I should like to call attention to those cases in which the bony development is not confined intra-capsularly, but extends far beyond the capsule, and we see a shortened, very broad ramus, with a partial or complete obliteration of the sigmoid notch, and in which there may be any degree of complete bony attachment to the base of the skull. Restricted mobility may be due to the broad bony neck impinging on the posterior surface of the glenoid fossa, or the broad coroncid impinging on the interior surface of the zygoma, or both. In cases of bony attachment or restricted mobility due to bony proliferation, it is necessary to remove much bone (the tendency is to remove less), in order to maintain adequate motion. It has not been my good fortune to operate in cases in which the bony attachment has been confined to the intra-capsular type. At times, the coronoid must be resected. The construction of an artificial joint by means of the formation of an hygroma derived from the fat and connective tissue is an ideal procedure, but, under the varying conditions obtained in these various ankyloses, it seems that the ideal reconstructed joint is seldom possible of attainment. In my experience, a better functional result is obtained by wide resection of bone and periosteum, including the contents

of the glenoid cavity, and closing the wound without interposition of anything between the bones. It seems also that better results are obtained by holding the jaws apart for a few days after operation by means of a wooden block wired between the molars. This certainly makes the opening of the jaws less painful. The patient should be provided with a gage (a stick of hard wood) as wide as it is possible to insert between the incisors. If this is inserted between the incisors three or four times a day, for months, it will maintain the degree of opening. If it is necessary to stretch and open the bite, it can be better accomplished by the constant pressure of rubber bands, rather than by intermittent pressure of a mouth-gage or similar instrument. As regards the other types of ankylosis, they should be treated, in general, by complete dissection of fibrous bands and the interposition of epithelium, by means of flaps of mucous membrane or Esser inlays. I should like to mention another possible etiologic factor in ankylosis and one which, as far as I know, has not been considered. Recently, with Dr. Harry Mock, I saw a patient who had an ankylosis and was suffering from myositis ossificans. The whole of the sternocleidomastoid from origin to insertion was replaced by dense bone. It occurred to us that inability to open the mouth might be due to the same process affecting the muscles of mastication on that side. We hope to clear up this point by further examination.

V. H. Kazanjian, Boston, Mass.: Dr. Beavis' paper covers, in a concise and clear manner, the most important points on bony ankylosis of the temporomandibular articulation. There cannot be any disagreement with the essential features brought out in this paper as they are based on sound fundamentals. This subject deserves more frequent consideration and discussion by oral surgeons because of the comparative frequency of occurrence of the condition and its effect on the general health of the patient. Trauma is given as the chief cause of bony ankylosis. This point is still debatable. Infections of various kinds are mainly responsible for ankylosis of the other joints of the body; therefore, we cannot consider the temporomandibular joint an exception. Even in the presence of trauma, the complicating factor is still infection. Without infection, the majority of the injured joints will heal without causing permanent disability. Patients suffering from arthritis deformans do not often suffer impairment of mandibular functioning, but two cases in my series have had bilateral ankylosis. Dr. Beavis emphasizes the fact that the diagnosis of ankylosis should not be looked upon lightly. This is well justified, as the nature of the treatment is guided by the location and type of the disease. In a given case of partial or complete ankylosis of the mandible, it is necessary to determine whether the condition is intra-articular or extra-articular. If it is intra-articular, we should know its exact location. For practical purposes, it is of secondary importance to determine whether or not the lesion is fibrous or bony, as in each instance the same type of operative measure is indicated. The resulting facial deformities in bony ankylosis are often quite disfiguring. They are, I believe, due to nonfunctioning of the mandible, plus the original infection, which causes arrested development of the mandible, rather than due to muscle stress. The muscles of mastication are rendered inactive equally on both sides, and therefore are not likely to be an influencing factor in determining the extent of the deformity. When ankylosis has developed in adult life and has lasted a considerable length of time, no appreciable change in facial contour is noticed. It is only when the disease has started in childhood that we notice various changes of the facial contour. In unilateral ankylosis of infectious origin, careful measurements of the two sides of the mandible will show distinct shortening of the affected side. This condition is also noticeable in children who have had severe infection of the jaw but have had no ankylosis. As Dr. Beavis has rightly stated, the treatment of intra-articular ankylosis is surgical. Forcible separation is possible only in fibrous ankylosis and will give very temporary relief. This is a justifiable procedure only in cases of an emergency operation, such as the removal of tonsils or aching teeth. No amount of mechanical interference will bring about any permanent relief. For the removal of bone, I have found the Kerrison back-biting forcep, used by rhinologists, a very handy instrument. When using this instrument, it is not necessary to follow the difficult procedure of passing a steel ribbon under the neck of the condyle to protect the underlying soft tissues. Dr. Beavis has described in detail the accepted surgical procedure, and it is well to remember that the most logical location of establishing

a new joint is at the neck of the condyle. A sufficient amount of bone should be removed to prevent contact of the two surfaces of the bone.

Truman W. Brophy, Chicago, Ill.: I found, many years ago, that there was a form of ankylosis of the mandible—intra-articular—which was not amenable to treatment in the immediate location of the ankylosis, and in the mandibular joint, so I made a curved incision just at the angle of the jaw in order to make a circuit in which the body of the mandible would work, and thus establish motion and function. In this particular case (in the day before the roentgen ray), I found not only filling in of the deposit in the articulation which seemed to extend forward even to the coronoid process, but also one great mass of bone from the head of the condyle down over the neck of it. To open up the neck of the condyle would not accomplish the end that we hoped for; consequently, I made the curved incision of the bone, and immediately the jaw began to function. I have performed many of these operations, which are not open to any objection that I have been able to discover. It has been said that the neck of the condyle should have been operated on. When this mass of bone tissue, all of which must be removed, or at least a good portion of it, stares one in the face, I doubt very much that that method is preferable to the one that makes a clean operation. This paper, like the other papers I have heard today, is making very desirable literature for this section of the American Dental Association. It is far in advance of anything that might have been presented forty-five years ago. We didn't think of going into things like this. Our meetings were devoted to practical subjects, all of which were good, but as for reaching out into this field, the dentist didn't do it.

Dr. Beavis (closing): In regard to Dr. Kazanjian's statement about the infectious processes being predominant and causing this ankylosis, I can see that that is perfectly true, but as there has been, in different parts of the country, different series of cases run, with ours I think that the presence of trauma was just a bit more frequent than was that of infection. Dr. Potts' is right when he states that, in extra-articular ankylosis, there is a periostitis causing proliferation of bone outside the cavities. One has to remove much more bone to get a functional result that will be just as good as in just a simple case of ordinary intra-articular ankylosis. Two weeks ago, we dissected a condyloid neck which was extremely wide and took out perhaps 2 cm. of bone. The patient, a young man, is getting along nicely now.

MINERAL METABOLISM IN RELATION TO ALVEOLAR ATROPHY IN DOGS*

By MARTHA R. JONES, Ph.D., San Francisco, California; F. V. SIMONTON, D.D.S., San Francisco, California, Collaborating

COLYER, in his "Dental Surgery and Pathology," presents distinct evidence of the presence of pyorrhea in early Egyptians as shown in some of the skulls in the Hunterian Museum. The earliest account of the disease is given by Ambrose Paré, in 1550. It was not until 1779 that Toirez introduced the term alveolar pyorrhea. He described the disease with considerable accuracy, but since that time, the term has been loosely applied to inflammatory conditions of the gum with and without alveolar necrosis.

According to the statistics gathered by

*Read before the Midwinter Clinic of the Chicago Dental Society, Jan. 26, 1927.

*From the Department of Pediatrics, the California Stomatological Research Group and the George Williams Hooper Foundation, University of California.

Blessing,[1] more than 350 different theories of the etiology and treatment of the disease have been developed. The literature on the subject is so voluminous that we shall make no effort to review it here. For the purpose of this discussion, we shall roughly group the types of pyorrhea as follows: (1) inflammatory: (a) local; (b) systemic; (2) non-inflammatory: (a) local; (b) systemic; (3) a combination of the above.

Degenerative changes of the investing tissues of known etiology, such as scurvy, poisoning of various kinds and Vincent's infection, will not be considered. We shall furthermore restrict ourselves to a discussion of the second group, and especially to certain dietary and constitutional factors which recent investigations indicate as exerting an important influence on the deposition and resorption of bone.

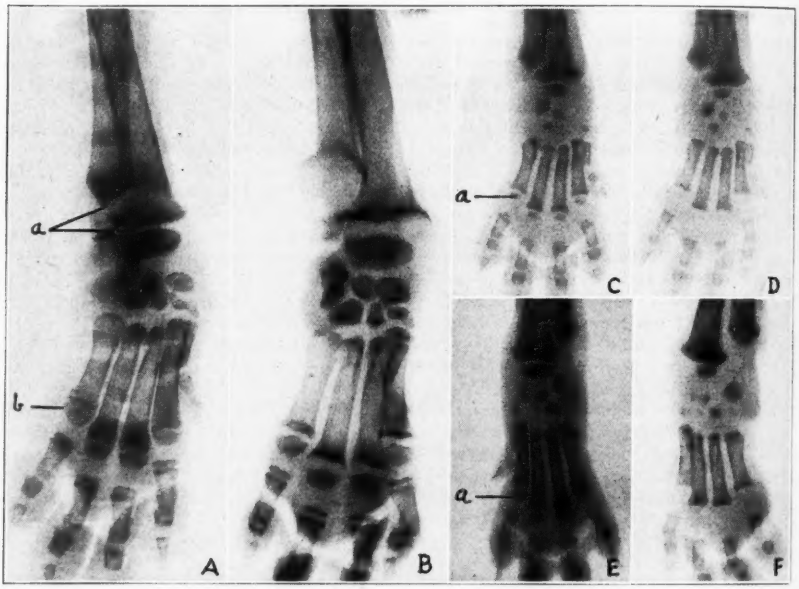

Fig. 1.—A: Lower fore leg of normal puppy at 70 days of age, fed on "basal" diet. B: Lower fore leg of a rachitic puppy of the same age fed on the same diet. Note the differences in the epiphyseal ends of the ulna and radius *a* and of metacarpals *b*. C and D: Lower fore legs of suckling puppies of the same litter at 28 days of age. Note differences in epiphyseal development at *a*. E and F: Lower fore leg of suckling puppies of different litters at 28 days of age. Note difference in development of carpal and epiphyseal bones. The puppies were born on the same day and were group mates on the same diet. The one in F developed profound skeletal defects and the other none which could be detected by roentgen ray.

1. Blessing, quoted by Kranz, P., and Falck, K.: Pyorrhea Alveolaris, Its Etiology, Pathology and Therapy, Berlin: Verlag von Hermann Meusser, 1922.

Fig. 2.—Left fore leg of a puppy taken at intervals. He was fed on the basal diet exclusively. A: Seven weeks of age; subnormal calcification indicated by retarded epiphyseal development. B: Nine weeks of age; calcification keeping pace with growth. C: Eleven weeks of age; satisfactory skeletal development. D: Thirteen weeks of age; continued improvement.

A brief review of the work on mineral metabolism in puppies and babies which has formed the foundation for the experimental production of alveolar atrophy in dogs and the metabolic studies on man seems desirable.

At the time that this research was undertaken, much emphasis was being laid on the calcium-phosphorus ratio of the diet in conjunction with a vitamin deficiency as an etiologic factor in the production of rickets-like lesions in the bones of rats. In the experiments reported, the diets most often used were markedly deficient in either calcium or phosphorus, as well as in vitamins, and, in addition, contained a large preponderance of base. Our own experiments on rats have shown this animal to be highly refractory to nutritional faults. It develops bone lesions only when subjected to most drastic measures; that is, marked deficiencies with greatly exaggerated disproportions in the bone forming elements. Human rickets, on the other hand, occurs with great frequency, even in breast-fed infants, and in a great variety of diets, many of which appear to be optimal from a nutritional standpoint. It is obvious, therefore, that, at least in man, some factor which renders unavailable or reduces the utilization of the bone-forming elements determines the onset of the

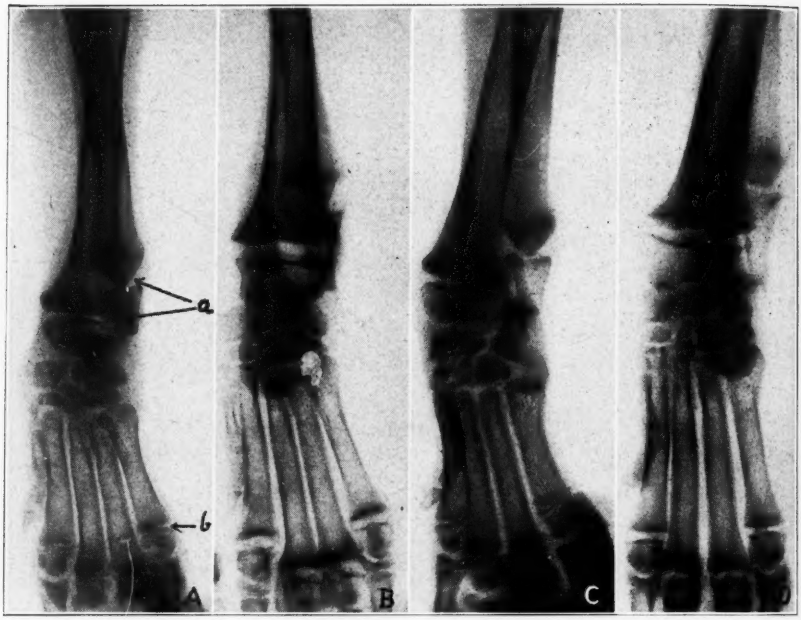

Fig. 3.—Left fore legs of two puppies of the same litter fed on the basal diet supplemented with salt mixtures which were relatively low and high respectively in their phosphorus content and varied in potential alkalinity. A: Puppy 2 at 98 days of age. A basal diet with high calcium salt mixture was supplemented with 1 gm. of phosphorus daily in the form of K_2HPO_4 potassium hypophosphites. Calcification satisfactory as indicated by epiphyseal development at *a* and *b*. B: Same animal at 140 days of age. Alkalinity of the diet was increased by adding sodium carbonate. Retrograde changes are indicated by widening of the epiphyseal zones at *a* and *b*. C: Puppy 9 at 98 days of age. The diet was the same as that of Puppy 2 except that the phosphorus was omitted. The skeletal development was comparable to that of his litter mates on the high phosphorus diet. D: Same animals at 140 days of age. The alkalinity of the diet was increased by the addition of sodium carbonate. The degree of bone destruction was altogether comparable to that suffered by Puppy 2 on the high phosphorus alkaline diet.

disease rather than any absolute deficiency or disproportion in the various food constituents. For this reason, the dog, which spontaneously develops skeletal defects comparable to those seen in man, was chosen as the experimental animal rather than the rat. The diet was planned so as to contain all of the known essential constituents in amount sufficient for rapid growth. It consisted of bread, milk, meat, butter fat and orange juice. In a few experiments, the various ingredients were proportioned on a percentage basis. In the others, it was constituted as follows: skimmed milk powder, 30 gm.; lean beef, 12 gm.; butter fat, 8 gm.; patent wheat flour bread, 100-300 gm.;

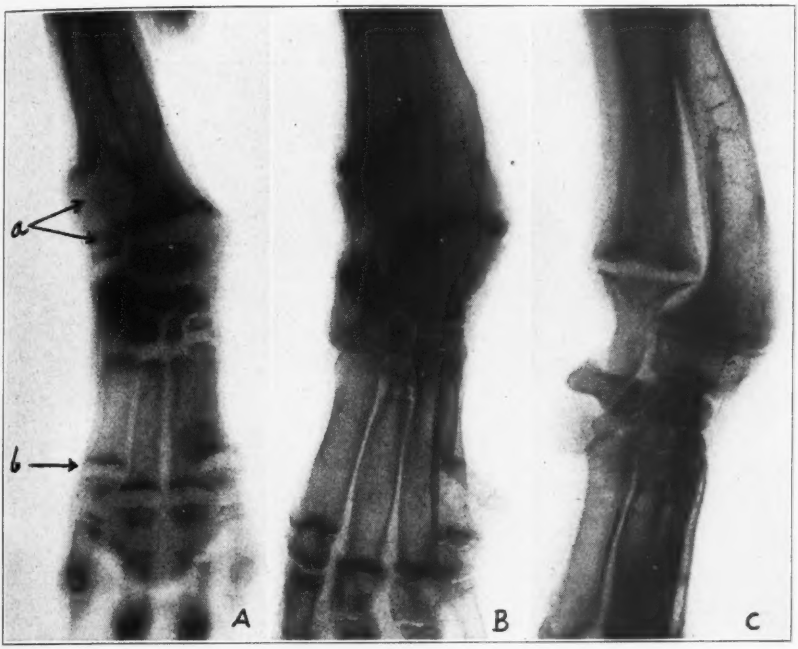

Fig. 4.—Left fore leg of Puppy 95, taken at various ages. After 88 days of age, he was fed on the basal diet. A: Profound rickets-like bone lesions developed on a mixed diet and under excellent hygienic conditions. Note epiphyseal zones at *a* and *b*. B: Age, 145 days. Cod-liver oil therapy resulted in rapid healing. Note increase in density of the metaphyses of the ulna and radius and narrowing of the epiphyseal zones. C: Age, 187 days. Cod-liver oil was discontinued and sodium carbonate added. Note marked decalcification of metaphysis of ulna.

orange juice, 10 c.c. The calcium-phosphorus ratio of the basal ration containing 100 gm. of dry bread, was 1, the absolute amounts of each of these elements ingested being approximately 0.4 gm. a day. No condition which could be attributed to a specific dietary deficiency was ever observed. The food was prepared quantitatively for each animal or group, the various ingredients being finely ground and made into a mush in order to prevent the exercise of choice on the part of the animal. In order to vary the calcium-phosphorus ratio of the diet, a salt mixture based on ash analysis of cow's milk, except that the phosphorus was omitted, was prepared and added to the basal ration. In certain experiments, the basal diet with the high calcium, phosphorus-free salt mixture was supplemented with potassium phosphate, in order to increase the phosphorus content. In still other experiments, potassium phosphate alone was added to the basal ration to create a greater disproportion in the calcium-phosphorus ratio. The potential alka-

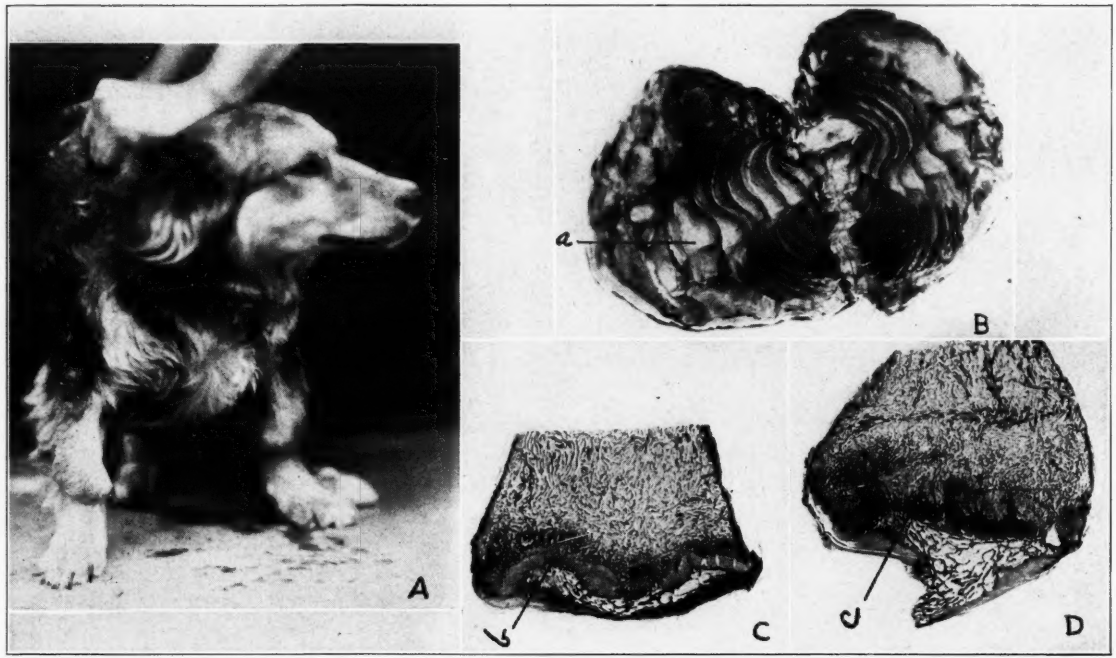

Fig. 5.—A: Puppy 6 at 38 weeks of age. Retrograde bone changes initiated on a potentially alkaline diet which was relatively high in calcium. The salt mixture was omitted at 20 weeks of age, which greatly accelerated the destructive process. The basal diet was continued, but the animal was kept for three and one-half months in an outdoor pen which was exposed to the direct rays of the sun during the day. The mineral content of his bones was found to be approximately the same as that of the control animal, which was killed at the time heliotherapy on Puppy 9 was started. B: Chest wall of Puppy 6. Note curvature of sternum and enormous enlargement of costochondral junctions. C and D: Epiphyseal ends of the radius and ulna, respectively. Note distortion of form with wide and irregular zones of uncalcified matrix at *b* and *c*.

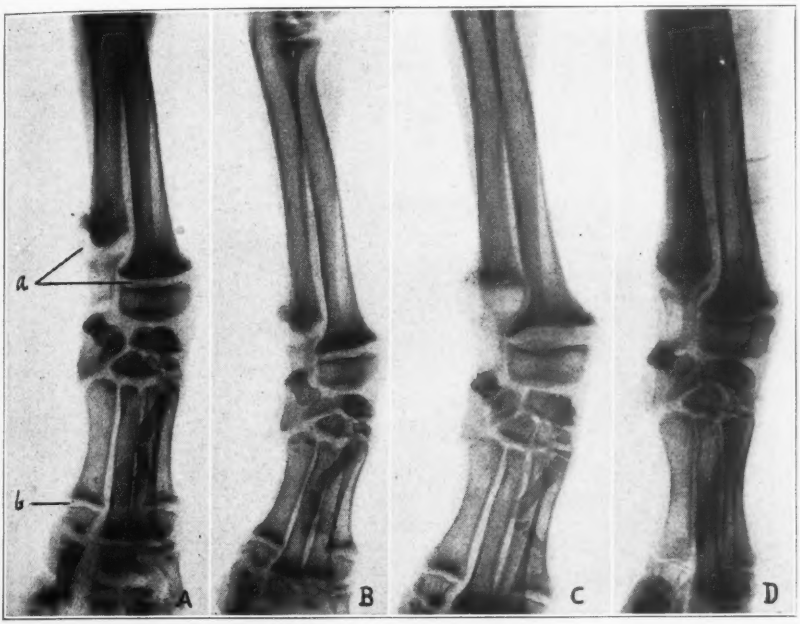

Fig. 6.—Left fore legs of two of the three puppies of the same litter which were fed on the basal diet, supplemented with an alkaline salt mixture which contained double the amount of calcium ordinarily used. A and B: Puppies 34 and 35, respectively, at 100 days of age. A destructive process is active to comparable degrees as indicated by the width of the epiphyseal zones at *a* and *b*. C: Puppy 34 at 128 days of age. No change was made in his diet. The increase in bone destruction is indicated by the widening of the epiphyseal zones. D: Puppy 35 at 128 days of age. The excess of alkali in his diet was neutralized with hydrochloric acid, the diet remaining otherwise the same. Note the increase in density of the epiphyseal zones. Compare regions at *a* and *b* in C and D.

linity of the diet was varied by adding sodium carbonate. Indoor wooden pens or galvanized iron wire cages were used, except in those cases in which sunlight was a factor.

Early in the study, it was observed that litters of puppies and even individuals of the same litter vary tremendously in their reaction to the same diet and hygiene. It was found that suckling puppies of the same litter which appear altogether comparable as far as physical conditions are concerned show marked differences in skeletal development on roentgen-ray examination. (Fig. 1.) Furthermore, ash analyses of freshly prepared bones of new-born puppies of the same litter show that the mineral content may vary greatly in the different individuals. The bones of some of our new-born puppies have been found to contain twice as much ash as the same bones of their litter mates. So it seems that certain individuals start out in life with a tremendous mineral deficit—a deficit which

enlargement of costochondral junctions. C and D: Epiphyseal ends of the radius and ulna, respectively. Note distortion of form with wide and irregular zones of uncalcified matrix at *b* and *c*.

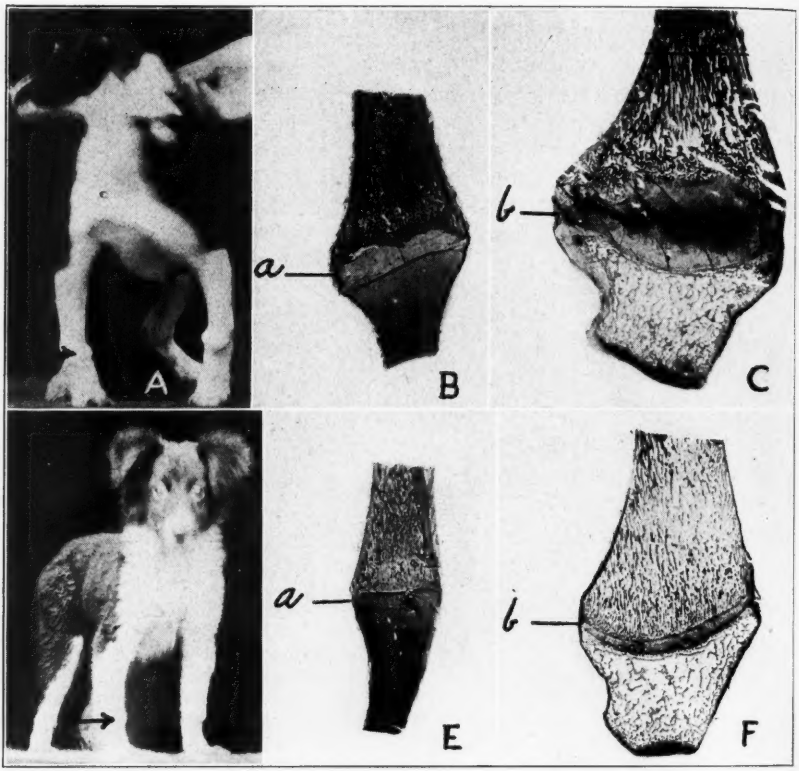

Fig. 7.—A: Puppy 34 taken at the time that it was killed, aged 128 days. B: Gross microphotograph of section of rib of Puppy 34. Note the wide zone of uncalcified matrix at *a*. C: Gross photomicrograph of section of radius of Puppy 34. Note the wide zone of uncalcified matrix at the epiphyseal zone *b*. D, E and F: Corresponding photograph of and sections from Puppy 35. Note the narrow and regular epiphyseal lines as compared with those in corresponding tissue from Puppy 34.

they may not be able to overcome in spite of excellence of diet or hygiene. These observations emphasize the necessity of determining the condition of each animal before putting it on an experimental diet, and the failure to do so by certain investigators who have assumed that all the individuals of the litter are comparable vitiates much of their work, but helps to explain many discordant results reported. For these reasons, roentgenograms were taken of most of the puppies at about 28 days of age, and of all of them at the beginning of the experimental diet. At the time of weaning, most of the animals were placed on the basal diet for a period of two or three weeks, during which time urine and blood analyses were made, the retention of

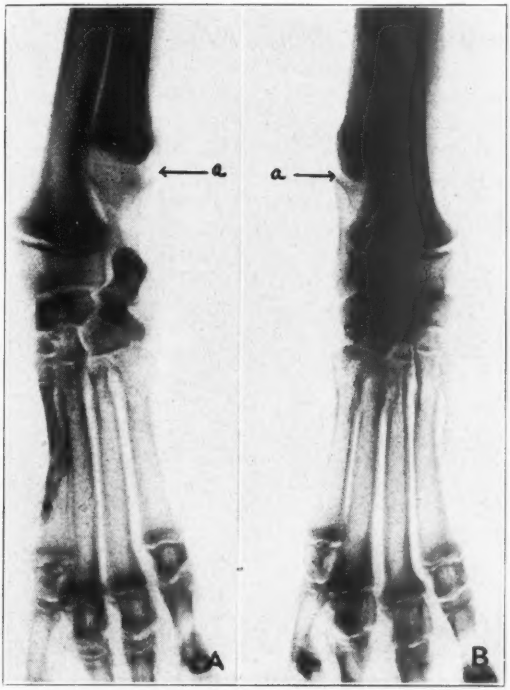

Fig. 8.—Effect on calcification of roentgen rays locally applied; right and left fore legs of Puppy 68 taken at the same time. The animal was being fed on the basal diet supplemented with a potentially alkaline salt mixture which was relatively high in calcium. The left fore leg was exposed to the roentgen rays at intervals of about two weeks. The "decalcifying" mechanism was retarded and finally reversed in this region in spite of the deleterious effect of the diet. Compare regions at *a* in the two legs.

calcium and phosphorus being determined in many cases. At the end of the preliminary period, roentgenograms were again taken and the animal was graded and grouped for the various diets. Metabolism and blood studies as well as chemical and roentgenographic examinations were repeated at intervals. During the course of the investigation, 138 puppies, representing twenty-five litters, have been studied more or less intensively. Of those fed on the basal diet exclusively, about 50 per cent showed satisfactory skeletal development (indicated by the roentgen ray), while the remainder showed roentgenographic evidences of faulty mineral metabolism. (Fig. I, A and B.) Likewise, some of those on diets high in calcium and relatively low in potential alkalinity developed rickets-like bone changes, and some did not. The same was true of those animals on the diets relatively high in phosphorus. In all cases, when the alkalinity of the diet was sufficiently increased, retrograde bone

changes were initiated, regardless of the calcium-phosphorus ratio (within the limits used) or of the concentration of the inorganic constituents. (Figs. 3-4.) Concomitant with this, there was an increase in the fecal excretion of calcium and phosphorus, which was usually accompanied by a reduction of the concentration product of these elements in the blood plasma and the carbon dioxid combining power. Unless the dietary fault was continually increased or shifted, there was a tendency for spontaneous recovery without change in either diet or hygiene, which agrees with the clinical experience in human rickets. Nature apparently minimizes the fault by shifting the balance in such a way that equilibrium is maintained and calcification proceeds.

After the initiation of retrograde changes, various measures have been instituted. The sudden withdrawal of the alkaline salt mixture from the diet of those animals undergoing retrograde changes apparently so disturbed the calcifying mechanism that bone destruction was greatly accelerated—so much so that subsequent heliotherapy, given daily for a period of three and one-half months, failed to be effective. (Fig. 5.) Of particular interest is the rapid and profound bone destruction observed in some of our subnormal animals which contracted distemper. In some instances, gross degenerative changes have been observed in a week's time; which shows the extraordinary rapidity with which the bone elements may be withdrawn when conditions are optimal.

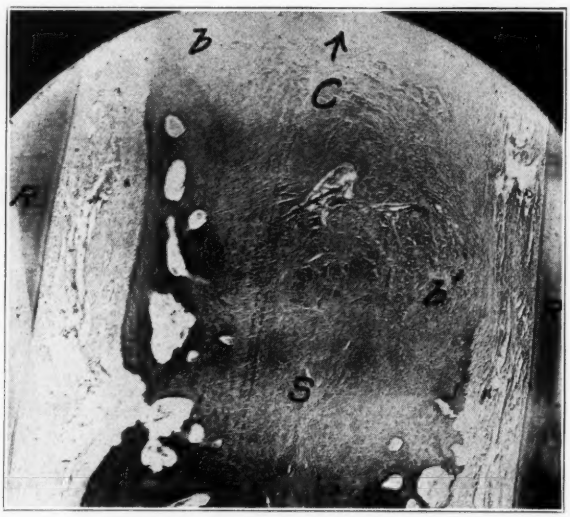

Fig. 9.—A longitudinal section through the upper first incisors and parodontium of Puppy 55. *C* is in the direction of the crowns. *R-R* indicate the roots of the teeth. Note the wide suture *S*, and the degenerative creases *b* and b_1 of the septal divisions, particularly the extreme retrograde condition at b^1.

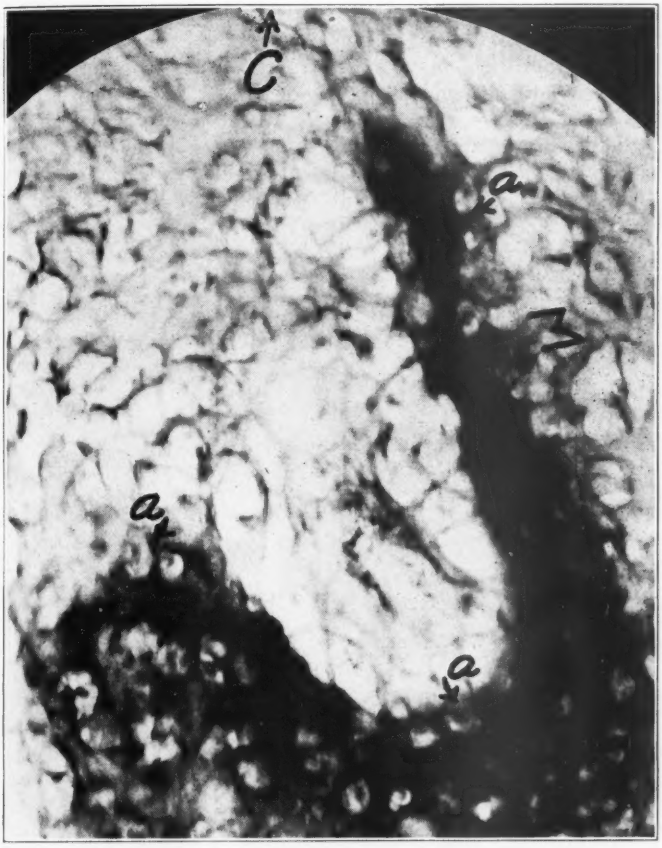

Fig. 10.—High magnification of the septal crest of the tissue shown in Figure 9. Note the small crenated nuclei of bone corpuscles. *a-a-a* indicate moribund cells. Observe eroded irregular marginal outline as at *M*. *C* lies in the direction of the crown.

Cod-liver oil promoted calcification in all cases. This is in agreement with observations reported by numerous investigators. Hydrochloric acid, given in sufficient quantity to neutralize the excess of alkali in the diet or that resulting from faulty metabolism promoted calcification. (Figs. 6-8.) Roentgen-ray therapy applied to one leg of certain animals undergoing retrograde bone changes on a decalcifying diet stimulated calcification in the region treated, in spite of the deleterious effect of the diet. (Fig. 8.) This would indicate that the seat of the disturbance in faulty mineral metabolism is in the bone-forming cells rather than in the gastro-intestinal tract as has been

generally believed. Further evidence in support of this view is the increase in calcification which occurs with inanition. Here, certainly, intestinal absorption cannot be a factor. Furthermore, it is difficult to explain, on the ground of faulty absorption, the large negative balances of calcium and phosphorus in a number of our animals on adequate diets. In certain experiments, the amounts of these elements excreted have exceeded the intake as much as 50 per cent; which indicates a destructive process rather than a mere failure of calcification.

Associated with skeletal defects produced in the experimental animal, a variety of dental conditions of the greatest interest have been observed.[2] Figure 9 shows postmortem tissue from Puppy 55. He was one of a litter of nine. At 6½ weeks of age, he weighed 3.1 kg. and appeared to be in an exceptionally good physical condition. With two of his litter mates, he was placed on the basal diet, supplemented with a potentially alkaline, high calcium salt mixture. During the following three months, rickets-like bone changes developed, but to a much less degree than in his group mates. The alkalinity of his diet was subsequently reduced by the addition of hydrochloric acid. Roentgenograms of his fore legs taken at intervals during the following two and one-half months showed progressive healing. Histologic sections of

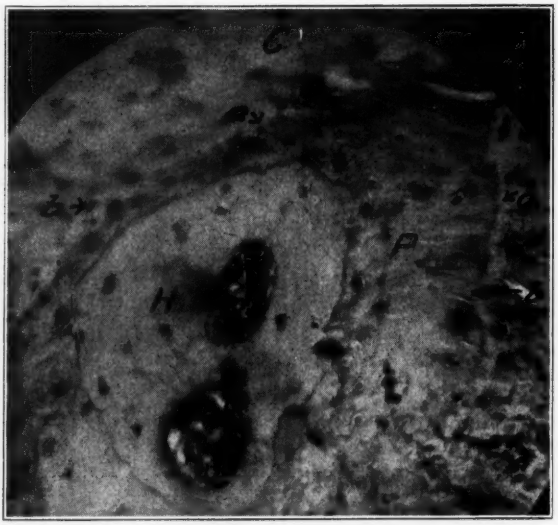

Fig. 11.—Septal crest of process from normal puppy of approximately the same age as Puppy 55 at the time that it was killed. *P* indicates subperiosteal bone; *H*, haversian system bone. Note the narrow strip of uncalcified matrix—prebone—at *a*, and the palisade of osteoblasts along the margins of the crest at *b-b*. *C* lies in the direction of the crown.

2. The histopathology of the dental tissues has been interpreted and described by F. V. Simonton.

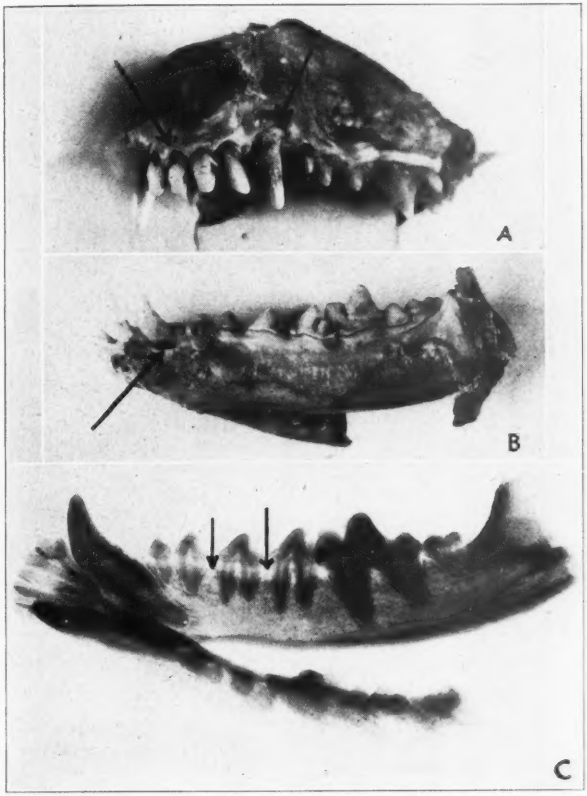

Fig. 12.—A and B: Upper and lower jaws, respectively of Dog 123. After he had attained the age of 7 months and appeared to be normal as far as could be ascertained by clinical, roentgenographic and dental examinations, he was placed on the basal diet supplemented with sodium carbonate. Note the pyorrhea-like lesions, recession of gums, serumnal calculus, etc. C: Lower jaw of this animal. Note the thinning of the alveolar crests.

the alveolar bone show profound retrograde changes but no evidence of an active constructive process, suggesting that skeletal and alveolar calcification proceed at different rates and that the latter is the more sensitive to dietary faults. This would coincide with observations on man, since parodontoclasia occurs frequently in individuals in whom the most critical medical examination fails to reveal systemic or skeletal defects. The section of Figure 9 passes longitudinally through the upper first incisors, and hence through the suture. The width of the suture and the distance of the crest of the process from the gingival lines of the teeth indicate a hypoplasia—an arrest of

Fig. 13.—Control material from Puppy 123; the septal process between the upper left second and third incisors. Note compact bone and generally regular margins. *R* is a root of a tooth. *C* lies in the direction of the crown.

growth. Figure 10 shows a higher magnification of the crest of one of the septal processes. The condition presented is interpreted as halisteresis.[3]

Halisteresis is figured as a condition where the lime salts have been leeched from the bone, leaving the organic matrix. It would be, in general terms, the reverse of osteoid, where the matrix has not yet been calcified. It is certain that we see histologic pictures of such conditions. It is justifiable to assume that the removal of lime salts must be accomplished by cell action. The most probable explanation is that the absorption is carried out by the bone corpuscles *in situ* in contradistinction to resorption where osteoclasts are in juxtaposition to the bone surfaces. Each bone corpuscle draws in its quota of lime from the region immediately around and under its influence. Such resorption may proceed with great rapidity.

3. There is some question at present as to just what halisteresis is, and, in fact, as to whether or not the condition exists. Bone resorption may be accomplished in various ways—by lacunar resorption, by perforated canals or, presumably, by halisteresis. The two former types of resorption are effected by mononuclear or multinuclear osteoclasts. The mononuclear osteoclasts are believed by Gallie and Robertson (Gallie, W. E., and Robertson, D. E.: Brit. J. Surg., 7: 211 [Oct.] 1919) to be merely osteoblasts in negative phase or with reversed activity. The multinuclear osteoclast is believed by Arey (Arey, L. B.: Am. J. Anat., 26: 315 [Jan.] 1920) to be a conglomerate giant cell resulting from the fusion of partly catabolized mononuclear osteoclasts with naked bone corpuscles.

Figure 11 represents a corresponding magnification of septal process of the growing bone of a normal animal of approximately the same age. The reasons for interpreting the conditions shown in Figure 10 as degenerative are as follows: The nuclei of many of the cells are small and crenated. In many others, the nuclei are absent. The moribund condition of such cells as *a-a-a* Figure 10 is obvious. It is, of course, always possible that, when tissues have been subjected to the chemical processes required in decalcification, embedding, etc., certain cell appearances may be artefactual. The disturbances figured are so marked that they are justifiably interpreted as real. Again, the large amount of uncalcified matrix and the eroded irregular marginal outlines all strengthen our diagnosis.

Fig. 14.—Material corresponding to that shown in Figure 13, but removed three and one half months subsequent to inauguration of a highly alkaline diet. Note halisteresis and lacunar resorption (*L-L-L*). *R-R* are the roots of the teeth. *C* lies in the direction of the crown.

Further evidence of gross retrograde change is afforded by the absence, in many of the sections, of septal process

between the teeth, even to the ends of the roots. In Figure 11, the appearances contrast strongly with those of Figure 10. The narrow, well defined strip of uncalcified ground substance—prebone—at *a-a*, and the palisade arrangement of the osteoblasts at *b-b* may be noted.

Puppy 94 was one of a litter of six all of which developed marked rickets-like bone changes in spite of the fact that they were fed on a good mixed diet with milk *ad libitum* and were kept in an outdoor pen during the greater part of the day. At 6 months of age Puppy 94 weighed 9.4 kg. Roentgenograms of the long bones showed active calcification, and the animal appeared to be in good physical condition. At this time, he was placed on the basal diet, with 2.5 gm. of sodium carbonate, which was increased to 4.5 gm. during the following four months. Retrograde changes in the long bones were indicated by marked bowing of the legs and thinning of the cortical bone, but epiphyseal changes appeared to be slight. His weight at the time that he was killed was 14.3 kg. Interesting differences are to be observed between Dogs 55 and 95. The latter, although spontaneously rachitic, was in an active phase of calcification during the development of his permanent dental structures and shows much less hypoplasia than Dog 55, which was undergoing degenerative changes during this period, although his initial physical state was markedly better. The suture of Dog 95 is not so wide as that of 55,

Fig. 15.—Resorptive change in root of upper right third incisor in tissue removed subsequent to alkaline experimental diet. Note osteoclasts at *a*.

and the septal crests approach nearer to the gingival lines of the teeth. Retrograde changes subsequently initiated by the change in diet are indicated by halisteresis, which is marked, and the lacunar resorptions from within the bone marrow spaces (osteoporosis).

Puppy 95, a litter mate of 94, also developed spontaneously marked skeletal defects. At 3 months of age, cod-liver oil therapy was instituted. Roentgenograms showed evidence of healing during the following seven weeks. Subsequently, the cod-liver oil was discontinued and sodium carbonate substituted, which promptly changed active calcification into a retrograde phase. (Fig. 4.) The alkali was discontinued after four and one-half months, and hydrochloric acid was added to the food mixture. Healing was evident in the long bones after a period of seventeen days. The weight at the time that the animal was killed (11 months) was 14.3 kg. Here again, there is no evidence of an active reconstructive process in the alveolar bone in spite of the fact that calcification was unmistakably active in the long bones.

Puppy 123 was received at the laboratory when about 7 months of age. His weight was 6.8 kg. All of the permanent teeth were present, as were also

Fig. 16.—Control material from normal adult Dog 12, aged about 3 years. Roots of the upper left second and third incisors (*R-R*). C is in the direction of the crown. The amount of subperiosteal bone is small. The septum is dominantly haversian. Margin *B* seems in equilibrium, while margin *A* is undergoing resorptive changes which are interpreted as physiologic, and due to tooth movement.

Fig. 17.—Biopsy tissue from adult Dog 8, aged 3½ years; tissue removed 130 days after diet in which basic ions were in excess was inaugurated. Note halisteresis at *B-B-B* and lacunar resorption at *D-D*. At D,[2] a resorptive process has completely divided the septum (in the plane of this particular section). Multinuclear osteoclasts may be seen at *E-E*. Note the widening of the pericementum at *P-P*. *R* and *R* are the roots of the teeth. *C* lies in the direction of the crowns and *A* in the direction of the apices of the roots.

the deciduous canines. The puppy appeared to be normal and in an excellent physical condition. He was placed on the basal diet consisting of bread, milk, meat, butter fat and orange juice supplemented with sodium carbonate. The amount of alkali was gradually increased during a period of three and one-half months from 1.5 to 3.0 gm. a day. During the last two weeks, his appetite failed and he lost weight. He was found dead in his pen, and appearances indicated that he had died in convulsions. Postmortem examination failed to reveal any gross pathologic changes, although dental examination showed a marked and rapid change in the oral conditions. The teeth were covered with a yellowish slimy deposit. There was considerable gingivitis, with definite recession of the gums, and around the canines and upper anterior teeth, a large deposit of serumnal calculus was found in a pocket labial to the lower right canine, strikingly resembling the picture of human pyorrhea. (Fig. 12.)

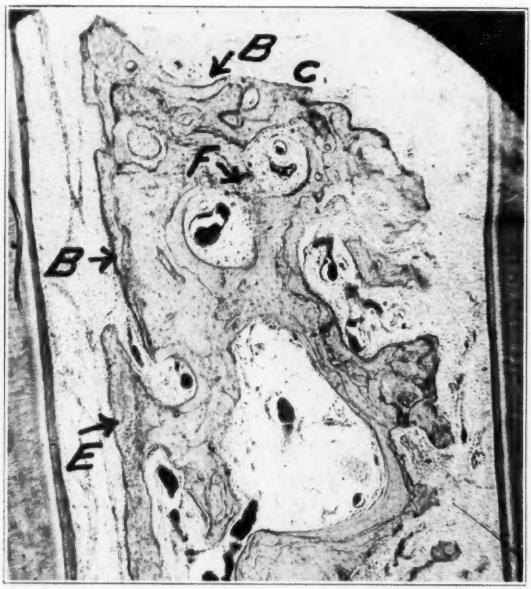

Fig. 18.—Material corresponding to that shown in Figure 17, but removed postmortem from the same animal seventy-six days after a change in diet. During the first forty-eight days, the soda was omitted, and during the last twenty-eight days, rice was substituted for potato. The diet was thus changed from the basic to the acid side. After seventy-six days, the animal died. New formation of bone is in evidence along the crest at *C*. At *E* may be seen old dead bone overlaid by new. At *F*, two marrow spaces which had previously coalesced have been separated by the bone growth between them.

Figure 13 shows the control tissue

(upper left second and third incisors) and parodontia removed at biopsy before the animal was placed on the experimental diet. The compact mass of bone and regularity of marginal outline form a striking contrast to the corresponding tissue (upper right second

We now come to the question: Do these conditions represent parodontoclasia, or, more specifically, pyorrhea of the non-inflammatory type? Although undoubtedly representing parodontal degeneration, they were, in general, associated with profound skel-

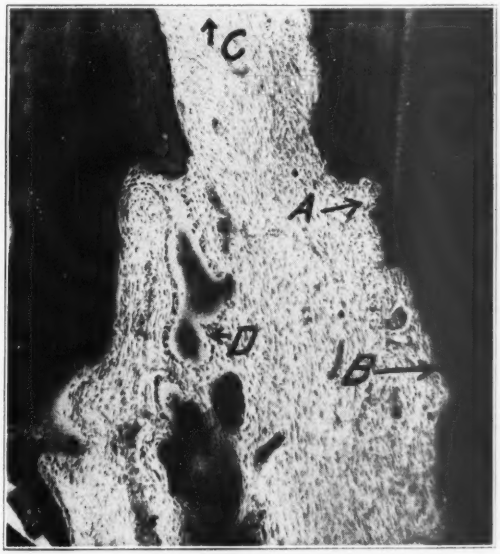

Fig. 19.—Region of apex of tooth, the same tissue shown in Figure 17; from Dog 8 subsequent to basic diet. Note resorption of cementum and dentin of root at *A* and *B*, respectively. Observe marked resorptive process in bone at *D*. This condition resembles the "diffuse atrophy" of Gottlieb. *C* lies in the direction of the crown.

and third incisors) and parodontia removed postmortem from this animal. (Fig. 14.) There are extensive halisteretic (*a-a*) and resorptive (*L-L-L*) processes. Figure 15 shows resorption of the cementum and dentin in the root of the upper right third incisor of this puppy. A row of osteoclasts may be seen at *a-a*. Other sections show resorbed areas without the presence of cells.

etal and other systemic changes. Parodontoclasia may occur in persons in whom the most careful medical examination reveals no deviation from health and general well-being. Therefore, it is necessary for the experimentalist who would convincingly produce parodontoclasia in an animal that he satisfy this criterion, namely, the production of degenerative changes in the investing

tissues without any obvious retrograde systemic changes.

In pursuit of this objective and in view of these findings, an investigation into the etiology of pyorrhea from the standpoint of mineral metabolism has been started and is now well under way. Observations cited below constitute only a part of a series of metabolic studies on both men and experimental animals, which are still incomplete. As the results obtained so far have been constant under fixed conditions, a progress report seems justifiable at this time.

PROCEDURE

Adult dogs were used which appeared to be normal as far as could be judged by clinical and dental examinations. The dogs were fed and kept in individual indoor wire and metal cages but were placed for several hours each day in outdoor runs paved with concrete. Two diets have been used. Diet 1 consists of patent flour wheat bread, 225 gm.; lean beef, 75 gm.; potato, 600 gm.; sodium chlorid, 5 m., and simulates the average American dietary. It is low in calcium, protein

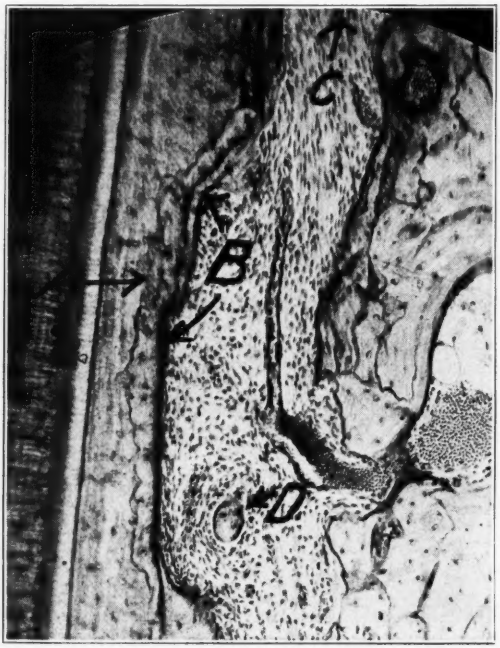

Fig. 20.—Tissue removed postmortem from Dog 8 and subsequent to acid diet. Resorption of cementum has occurred at *A* and has been covered by a strip of tissue *B*. New bone *D* has grown in the area previously occupied by the root. *C* lies in the direction of the crown of the tooth.

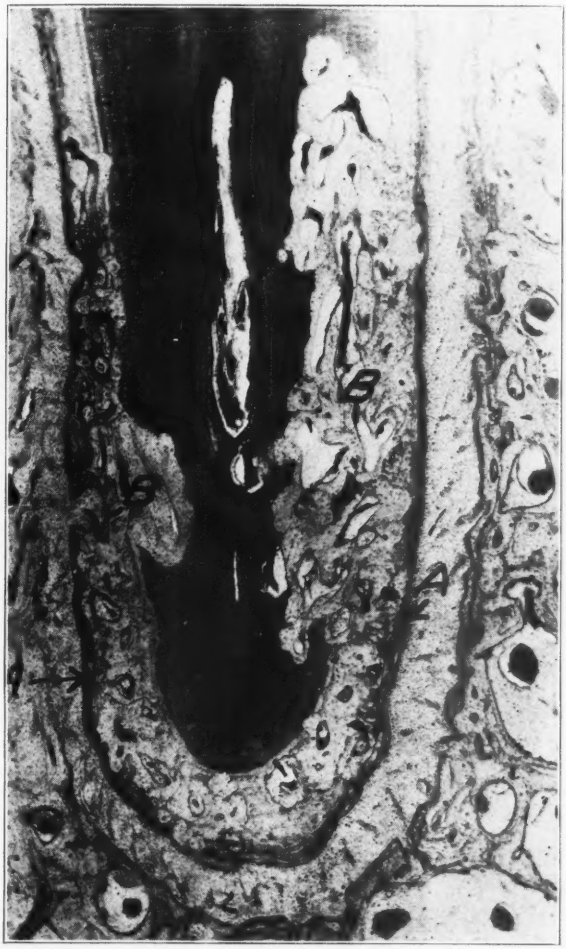

Fig. 21.—Apical region of the tissue shown in Figure 20. Note resorption of the root and repair with haversian system bone (*A-A*, cementum; *B-B*, bone). The perfection of restored contour is notable. *C* lies in the direction of the crown.

and vitamins and contains an excess of base. Diet 2 consists of dried bread and fresh lean beef in equal parts. It is relatively high in protein, low in calcium and vitamins and potentially acid in reaction. In spite of the fact that both diets are relatively low in vitamins, we have never observed any condition which could be attributed to a vitamin deficiency. The proteins of these diets are of good quality and sufficient in quantity for the maintenance of body

Fig. 22.—Dental tissues from Dog 14 after he had been on an alkaline diet for a period of 5 months. A: Section of lower jaw showing marked resorption of the root ends and rarefaction of the alveolar crests. B: Gross photomicrograph of section of tissue taken from the specimen shown in A. C: High magnification of region in section of tissue shown in B. Note the layer of bone surrounding fragments of roots at *A-A-A*.

weight. The acid-base balance of both diets has been varied by the addition of small and gradually increasing quantities of sodium carbonate. In some experiments, the vitamin content of the diet was further reduced by autoclaving the food at 15 pounds pressure for three hours. None of the animals on the autoclaved food ate well, and all lost considerable weight, which vitiated the results of the experiment. Before beginning the experimental diets, each animal was given a thorough dental examination, including roentgenograms. With but few exceptions, the upper left second and third incisors with investing tissue were excised under anesthesia and prepared for microscopic study to serve as control material for tissue subsequently removed. Blood and urine analyses have been made at intervals during the course of the study. To date, a small part of the experimental material has been examined. Only the more striking illustrative conditions will be described, as the working out of the detail of the microscopic pictures and the unraveling of the complex of factors which our observations have shown to be present will require long study of a great mass of material.

Fig. 23.—Tissue removed from Dog 12 after two months on an alkaline diet. The alveolar crest had receded about half the length of the root. The field shows the receded crest (*B-B-B*) of the septum between the upper right second and third incisors. *A-A-A* indicates decalcified bone matrix. *C* is in the direction of the crowns of the teeth.

The conditions and changes in the alveolar process to be shown in the following cuts were produced without any

obvious[4] skeletal changes. The animals *appeared* to continue robust throughout the experiment, in some cases to the time that they were killed and in others to the time when lethal reactions occurred.

Figure 16 presents a longitudinal section through the upper left second and third incisors of a robust appearing, presumably normal adult dog (No. 12), aged (estimated) 3 years. The crest of the septum has apparently reached its full extent crownwise (the gingivae are not shown in this cut). There is a relatively small amount of subperiosteal bone in the septum, which is dominantly haversian but undergoing cancellous transformation. Margin *B* appears to be in equilibrium, but a series of lacunae of Howship are to be seen along margin *A*. In these are multinuclear osteoclasts. This condition is interpretable as normal: it is probably a result of tooth movement. (The second and third incisors in the dog are not in contact, so slight shiftings in relationship are to be expected.) No evidences of halisteresis or osteoporosis are apparent in this tissue.

Fig. 24.—Control tissue from Dog 13; upper left second and third incisors and parodontium. Note compact, healthy septal bone.

Figure 17 shows a section of tissue removed at biopsy from Dog 8, a normal adult, 3½ years of age, 130 days after being placed on a diet in which the basic ions were in excess (bread, meat and potato, the latter predominat-

4. Undoubtedly, any systemic factor which will produce retrograde change in the alveolar process may also affect the skeletal system, however slightly. All that the criterion demands is freedom from *obvious* change.

ing), with the addition of sodium carbonate to further increase the alkalinity. At the time of biopsy, the animal appeared to be robust, well nourished and in good health.

The roots of the upper right second and third incisors are shown at *R* and nuclear osteoclasts may be seen at *E-E*. Widening of the pericementum is evident at *P-P*. This results from the narrowing of the septum through resorptive changes. The freedom of the soft tissues from any evidence of inflammatory processes is notable.

Fig. 25.—Tissue corresponding to that shown in Figure 24, but removed five months subsequent to the inauguration of a bread, meat and potato diet.

R. *C* lies in the direction of the crowns, *A* toward the apices of the roots. The septum of the alveolar process shows marked changes. Halisteresis has occurred at *B-B-B*. Lacunar resorptions are evident at *D-D*. At $D,^{2}$ a complete division of the septum (in the plane of this particular section) has occurred. Osteoporotic changes are evident in the marrow spaces. Multi-

Subsequent to the biopsy, omission was made of the soda from the food mixture during the following forty-eight days. Reversal of the dietary reaction was then effected by the substitution of an equivalent amount of rice for the potato. Twenty-eight days after this change, the animal died in convulsions.

Corresponding tissue (the upper left

second and third incisors) was removed postmortem.

Referring to Figure 18, marked reconstructive changes are evident. The roots of the upper left second and third incisors are shown at *R* and *R*. The subperiosteal bone (*B-B*) is fairly abundant. Along the crest *C*, new bone formation is taking place. Under higher magnification, osteoblasts may be seen embedded along the margin as bone corpuscles, many appearing between the margin of the bone and the outlying blood vessels. The superficial bone corpuscles are large and their nuclei regular in outline and clearly defined. At *E*, old dead bone overlaid by new may be seen. At *F*, two marrow spaces which had previously coalesced have been separated by bone growth between them. Sections of the long bones showed no *apparent* recent changes of the osseous tissue.

Fig. 26.—Upper left lateral region of a man, aged 28, with a negative medical history but marked alveolar atrophy; before treatment.

Figure 19 shows a field of tissue from the biopsy material. Resorption of the cementum and dentin of the root at *a* conforms with that described by Gottlieb in relation to diffuse atrophy.

Figure 20 shows a region from the later postmortem material of this animal. It lies at about the center of the length of the root. Here, a resorption of root which had occurred as at *A* has been covered over by the tissue at *B* and bone *D* has grown into the space made by the resorption. The histologic significance of these appearances is evident.

Figure 21 shows the apical portion of the root of one of the teeth from the same specimen as Figure 20. The layer *A-A* is interpreted as cementum and the tissue *B-B* as bone.[5] This perfection of restoration of contour of the root is only an occasional finding.

Fig. 27.—Region shown in Figure 26, after two months on roentgen-ray and acid milk therapy.

Again, roots may be divided at right angles to their length and the bone of the process grows through, permanently separating the divisions (Fig. 22 B). Often the bone of the process grows into the region where resorption of the root has occurred, or a movement of the tooth will bring about the same result, thus preventing a restoration of the root to its previous contour.

Figure 23 shows postmortem tissue from Dog 12. Control material (upper left second and third incisors with investing tissue) was shown in

5. Space does not permit an adequate discussion of the reasons for these interpretations, which must be reserved for later presentations.

Figure 16. Dog 12 was a large robust animal weighing 23 kg. He was placed on the bread, meat and potato diet supplemented with sodium carbonate. After six weeks on the diet, the dog had the appearance of being dizzy and was very unstable on his feet. Two weeks later, he went into convulsions and died. The section shown in Figure 23 was cut longitudinally through the upper right second and third incisors. Resorption had ravaged these tissues. The septal process *B-B-B* has retreated half the length of the root. It will be seen that, over much of the field *A-A-A*, nothing but bone matrix remains.

Dog 13 was a large vigorous male, weighing 20 kg. and estimated to be about 6 years of age. His dental and physical conditions appeared to be excellent. Figure 24 shows control tissue (upper left second and third incisors) which was excised before the experimental diet was started. The septal process is dense and in excellent condition. The animal was placed on the bread, meat and potato diet *without* soda, in an effort to determine the effect on alveolar bone of an alkaline diet composed of such natural foods as enter into the constitution of the average American dietary. Figure 25 shows the corresponding tissue excised after the animal had been on the diet for a period of five months. A surprising amount of degeneration is evident. Halisteresis occurs at *a-a-a*, and lacunar resorption at *b-b-b*. Subsequently, soda was added to the diet for a period of three months, and the animal was killed. This tissue has not yet been sectioned. A report on certain metabolic findings on this animal is given below.

Dog 14 was a young adult Airedale weighing 17.3 kg. As in the other experiments, control material was removed at biopsy before starting the diet. Degenerative changes, as evidenced by the resorption of the cementum, had occurred, but had been repaired by the deposition of bone, which completely filled the excavated region. The animal was placed on a bread and meat diet (equal parts) to which was added gradually increasing amounts of soda (2.0 to 4.5 gm. a day) for a period of five months. During the last month on the alkaline diet, the dog showed evidence of nervousness and appeared to be apprehensive. He finally went into convulsions and died. Roentgenograms of the jaws showed profound resorption of the root ends of the premolars and rarefaction of the alveolar bone. Photomicrographs show complete division of some of the roots of the premolars. The fragments are covered over by narrow strips of new material, and bone has grown betweeen them. Concomitant with this, alveolar bone has suffered retrograde changes to such an extent that a mere skeletal structure remains.

COMMENT

In view of these findings, it would seem that the seat of disturbance in faulty ossification is to be found in the bone-forming cells rather than in the gastro-intestinal tract as has generally been believed. Furthermore, the rate of calcification in different regions varies and is subject to local factors. The ability of a cell to function depends, first, on its integrity, which is determined by the constitutional or systemic condition inherent in the individual, and second, on its environment—the composition of the tissue

fluids. Under normal conditions, a certain balance of ions which is optimal for calcification exists between the bone-forming cells and their surrounding medium, and it is logical to assume that any factor, whether dietary, systemic or local, which upsets that balance will interfere with cell function. In proportion to the degrees of metabolic fault, there will be a progressive failure of calcification, and ultimately, resorption of bone. Conversely, any agent which either directly or by catalysis exerts a favorable influence on the metabolism of the bone cells will tend to restore the optimal balance of ions, and calcification will be resumed. In our experience, retrograde bone changes, accompanied by an increase in the excretion of bone salts, have invariably resulted in dogs after excessive alkali feeding. Neutralization of the excess of alkali with hydrochloric acid initiated healing. Macleod and Knapp[6] have shown that there is also an increase in the lactic acid content of the urine of men and cats after the ingestion of sodium bicarbonate. In experiments on adult dogs and men (to be reported later), the addition of soda to the diet has been accompanied by an increase in the excretion of organic acids in the urine, but a causal relationship between these two phenomena (increase in the excretion of organic acids and bone salts) has not yet been established. In the absence of contradictory evidence, we are inclined to interpret these findings in support of the theory that excessive amounts of alkali in the diet tend to depress cell function. If the activity of the cell is reduced, one would expect an increase in metabolic products which are incompletely combusted—organic acids which, if formed in sufficient amounts, would combine with the base of the tissues and would ultimately result in the resorption of bone. In support of this might be cited the case of a young man, aged 28, who had marked alveolar atrophy with little inflammation. Medical examinations proved to be negative. His diet, at the time the metabolism studies were made, was quite well constituted, although he professed a great fondness for and an overindulgence in sweets prior to the discovery of his dental condition. The organic acid excretion in the urine was found to be relatively high. His diet was then supplemented with one quart of whole milk, to which was added 10 c.c. normal hydrochloric acid. After three weeks, the tests were repeated. The organic acid content dropped 20 per cent in spite of a 23 per cent increase in the nitrogen excreted. At the time acid milk was introduced into the diet, roentgenograms of all the teeth were taken. A highly rarefied region—the site of a root amputation—was evident in the alveolar bone at the apex of the root of the upper right lateral incisor. After a period of about two months, during which roentgen-ray treatments were given at intervals of two weeks, roentgenograms were again taken. The impression one gets from a study of the two sets of films is that of a general improvement. There is a definite increase in density of the rarefied region described above and a slight filling in of the septal crests in certain regions. (Fig. 26.)

Shohl and Sato,[7] in their work on

6. Macleod, J. J. R., and Knapp, H. J.: Am. J. Physiol., 47: 189 (Nov.) 1918.

7. Shohl, A. T., and Sato, A. J.: Biol. Chem., 58: 257 (Nov.) 1923.

mineral metabolism in babies, showed that the addition of both sodium bicarbonate and hydrochloric acid (in the concentrations used) to a cow's milk formula resulted in a decrease in the retention of a calcium, phosphorus and chlorin. Aub and his associates[8] showed that an analogy exists in the metabolism of lead and calcium and that the excretion of these elements is increased by both acids and alkalis. Our own experiments to date have been restricted to the production of retrograde bone changes by means of feeding excessive amounts of alkali, and calcification has been initiated simply by adding enough hydrochloric acid to reduce the excess. The frequent occurrence of rickets on high carbohydrate diets has long been recognized, and bone lesions resulting from vitamin deficiencies have been the object of numerous scientific investigations during the past decade. Furthermore, the poor quality of alveolar bone and the extraordinary slow healing of fractures of diabetics are matters of common observation. All of this evidence tends to show that bone is a more labile tissue than it has generally been thought to be and its integrity is dependent on a great variety of factors which may be of systemic, dietary or local origin. If the body mechanism is faulty, retrograde bone changes will occur in spite of the excellence of diet or hygiene; to wit, rickets in breast-fed infants. Whatever the fault may be, Nature makes an effort to minimize it and gradually adapts herself to the condition, if it is not too severe, and calcification is resumed. In proof of this may be cited the spontaneous healing in rickets which occurs frequently without change in diet or environment. Likewise, the most perfect cell mechanism will eventually succumb to the deleterious effects of a faulty diet and the end results will be the same—a failure of calcification and, finally, the resorption of bone. If the interpretation of our findings is proved to be correct, it offers a satisfactory explanation of the incidents of rickets in children and pyorrhea in adults on widely differing diets and under a great variety of conditions. Analysis of the diet (bread, meat and potato with and without soda) on which adult dogs developed pyorrhea-like lesions (alveolar atrophy) shows it to be high in calories, low in protein, vitamins and calcium with a preponderance of base—a combination which appears to be unfavorable for calcification in the absence of sunshine. Brood bitches fed on this diet for a year or more give birth to litters of puppies which show no physical defects but develop rickets-like lesions even before weaning. The diet and hygiene of these animals subsequent to weaning determine the severity of the rachitic process. It is significant that bread, meat and potato form the foundation of the average American dietary, on which the incidence of pyorrhea is increasing at an alarming rate. Also, it is said that 75 per cent of the babies in some of our large American cities show clinical evidence of rickets. The dietary habits of other races in relation to bone diseases are of interest. The Eskimo is reputed to be remarkably free from pyorrhea and skeletal defects. He is essentially carnivorous. He eats the muscle and organs of animals and drinks their blood as well. Furthermore, he exercises vigorously. His diet is potentially acid in reaction, is high in protein (which has

8. Aub, J. C.; and Fairhall, L. T.; Minot, A. S., and Reznikoff, P.: Medicine, 4: 1-250 (Feb.-May) 1925.

long been known to have a specific dynamic action) and rich in vitamins. These factors, in combination with the stimulating effect of cold and vigorous muscular exercise, would tend to promote cell activity. The proper balance of ions between the tissue fluids and bone cells is maintained and calcification proceeds. The same theory serves to explain the relative immunity to dental and skeletal disease of certain tropical races whose diets and modes of living are radically different from those of the Eskimo. Native races in the tropics exercise little. They are essentially vegetarian. Their diet is relatively low in protein and high in minerals and potential alkalinity, but it is largely constituted of unrefined foods, many of which are eaten raw. The high vitamin content of fresh fruits, vegetables, nuts, milk, etc., combined with an abundance of sunshine, stimulates metabolism to such a degree that the bone cells are able to overcome the deleterious effect of a highly alkaline diet. Then, too, each of these peoples has developed a high degree of adaptability to their particular diet and environment, and if either is suddenly changed, may deteriorate physically to a considerable degree before Nature is able to adjust herself to the altered conditions. One cannot but be impressed by the rapid dental deterioration suffered by immigrants from Central Europe after they have been subjected for only a few months to American foods and modes of living. These observations place alveolar atrophy in the category of bone diseases. It may be of dietary origin, and, if so, is subject to dietary control.

SUMMARY

1. The dog develops spontaneously skeletal and dental defects comparable to those seen in man, and for this reason is superior to the rat for certain metabolic studies.

2. Litters of puppies, and even individuals of the same litter, vary tremendously in their reaction to the same diet and hygiene, and in order to evaluate experimental results, a knowledge of the initial skeletal condition of the animal is of prime importance.

3. In the absence of sunshine, two factors are primarily concerned with the deposition and resorption of bone in puppies, the first and probably more important being the metabolic state which is inherent in the individual; the second, diet.

4. An excess of alkali in the diet, regardless of its calcium-phosphorus ratio (within the limits used), consistently initiated retrograde bone changes in apparently normal puppies and greatly accelerated the destructive process in subnormal individuals. Concomitant with retrograde changes, there was an increase in the excretion of bone salts.

5. The omission of the alkaline salt mixture from the diet of animals undergoing retrograde bone changes resulted in rapid and profound bone destruction, in spite of the fact that the diet was well constituted.

6. Hydrochloric acid in quantities sufficient to neutralize the excess of alkali in the diet, cod-liver oil and roentgen rays all promoted calcification.

7. The seat of disturbance in faulty mineral metabolism appears to be in the bone forming cells rather than in the gastro-intestinal tract as has been generally believed.

8. Dental conditions of great interest have been found associated with skeletal defects produced on experimental diets and have been described.

9. Diets which are potentially basic in reaction, low in calcium, protein and vitamins (bread, meat and potato), with and without the addition of sodium carbonate, have, in all cases so far examined, resulted in retrograde changes in the alveolar bone of apparently healthy, robust, adult dogs. These changes, namely, halisteresis of the crests of the septal processes, osteoporosis and lacunar resorptions of the ends of the roots of the teeth, are strikingly similar to the diffuse atrophy in human tissue described by Gottlieb. These lesions are regarded as fundamental to the noninflammatory type of parodontoclasia of systemic origin, the most destructive and hitherto obscure form of pyorrhea.

10. The substitution of rice for potato in the diet was accompanied by a regeneration of alveolar bone and remarkable reparative phenomena in the roots of the teeth. The substitution or repair of eroded dentin by haversian bone is described, and, to our knowledge, for the first time.

11. Evidence is presented indicating that roentgen rays may be a therapeutic agent of great value in the treatment of parodontoclasia and an aid to the repair of bone.

12. The alveolar process appears to be more susceptible to slight dietary faults than do the long bones and, in young puppies, responds more slowly to therapeutic measures.

13. A study of the food habits of races which are relatively immune to dental and skeletal disease shows that a high protein diet which is potentially acid in reaction (flesh), even though it is relatively low in calcium, is well suited to the needs of those inhabiting the arctic regions in spite of the fact that a large portion of their lives is spent in darkness. On the other hand, the calcium salts in a low protein, basic diet (fruits and vegetables) may be equally well utilized in those regions where sunshine is abundant.

14. Clinical observations and experimental findings indicate that ossification is the resultant of a large number of factors. It is believed that bone is a more labile tissue than it has generally been thought to be, and that ossification depends on the maintenance of a certain balance of ions between the bone cells and their surrounding medium. If this is true, any factor of any origin whatsoever, if it is capable of altering that balance either by action on the cells themselves or the tissue fluids, is a determining factor in that individual in regulating the deposition and resorption of bone.

GOLDENBERG'S VACCINE IN BUCCODENTAL THERAPEUTICS*

By LEON FRISON, Paris, France

I. VACCINOTHERAPY IN CASES OF PYORRHEA ALVEOLARIS

WE have had occasion to make a serious study of the question of vaccinotherapy in cases of pyorrhea alveolaris for the last four years, especially in connection with the treatment of pyorrhea alveolaris. This condition is one of the most difficult problems in dental pathology. It has given rise to an abundant literature, as regards both the etiology of the disease and the treatment.

We were the first to experiment and apply the biologic treatment, which has given us good results, and therefore we were anxious to bring this subject before you on the occasion of this important congress.

Before entering into the study and the mode of application of Goldenberg's vaccine, it would be useful to review briefly the several attempts made to combat pyorrhea, prior to our first investigations. I need not recall to your minds that Wright is "the father of vaccinotherapy." It was he who first thought of employing microbic emulsions against certain infectious diseases, that is to say, germs killed by heat and held in suspension in physiologic sodium chlorid solution. Subsequently, numerous investigators devised various means of preparing vaccines, and of destroying or lowering the vitality of micro-organisms destined to enter into the composition of vaccines. No less varied were the different ways of introducing those preparations into the body: they tried successively hypodermic, intramuscular and intravenous injections.

From a review of the dental literature published the world over, one can gather that almost every possible variety of vaccine has been employed in the treatment of pyorrhea and applied in the various ways enumerated.

We must admit that the results, not having proved satisfactory, that mode of treatment has been gradually set aside by practitioners. We have, together with Dr. Goldenberg, sought to explain that apparent failure. In a communication which he made to the Odontological Society of France in 1923 (reproduced in the January, 1924, issue of the *Revue Odontologique*) he brings forward a very plausible explanation. To use his words:

> Those failures find a ready explanation thanks to the new ideas now obtaining regarding immunity. Up to now, the object of vaccination in pyorrhea was, by developing anti-bodies, to create a general immunity of the whole organism. In the disease under review, the formation of anti-bodies is not easily obtainable. The germs connected with pyorrhea and which one has to make use of in the preparation of the vaccine (staphylococci, streptococci, etc.) are in fact known as being poor inciters in antibody formation.

*Read before the Section on Periodontia at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 23, 1926.

Besides, even if it had been possible to cause an adequate formation of antibodies, their usefulness would have been seriously diminished through the deficient nutrition of the dental system in pyorrhea and on account of the capillary stasis resulting from the inflammatory process. In fine, the dead tissue which lines pyorrheic pockets and which forms a characteristic feature of the disease constitutes an almost unsurmountable barrier, so much so that the antibodies cannot reach effectively the germs in the infected foci.

In order to obtain a practical confirmation of that hypothesis, Goldenberg conceived the idea of preparing a new vaccine, working on the lines laid down by Besredka on local immunity. As it is not our intention to treat fully, in this communication, of the work of Besredka regarding that question, we shall be content with simply recalling to your minds that local immunity aims at protecting not the whole organism but only a limited area. Besides, in order to gain that end, it is necessary that the vaccine follow the same path as the causative germ. To sum up, the vaccine must be introduced into the very organ or tissue which is the seat of the infection.

It was under those conditions and acting according to those principles that Goldenberg thought of obtaining immunity of the gingival region by introducing a vaccine into the gum itself. That vaccine, he presented to us in 1922. We were immediately interested by the arguments he brought forward concerning local immunity when the previous attempts made at obtaining general immunity had been attended with such poor results. We resolved to start a special clinic for pyorrhea patients at our school on whom we would officially experiment with the vaccine. I mean to lay stress on the fact that a general tonic treatment, as well as a local surgical one, was never overlooked; it has on the contrary, been followed concurrently with the vaccine treatment. The latter has always been looked on by us as an adjunct, very valuable, no doubt, to all means of intervention, medical, alveolodental and gingival, which constitute the treatment of the different forms of pyorrhea.

COMPOSITION AND SPECIAL QUALITIES OF VACCINE

This is a stock vaccine found ready made on the market. It differs from the autovaccine, which is prepared, as you know, from pus obtained direct from the pyorrhea pockets of the patient to be treated.

It is polyvalent, that is to say, it contains several strains of the same germ. It is also mixed or polymicrobic, because it contains different kinds of germs, streptococci, staphylococci, enterococci, *Micrococcus tetragenus*, Friedlander's pneumobacillus, etc.

Further, and this is an important point, it is highly concentrated. It contains 1,000,000,000 germs per drop, instead of per cubic centimeter, which is the strength of vaccines usually employed.

Finally, it escapes the serious drawback of buccal vaccinotherapy, which consists of the injection of a large volume of liquid into the gingival tissue. In order to avoid the injection of a great quantity of vaccinal fluid into the gums, Goldenberg thought of concentrating his vaccine and condensing it to a small volume without in any way diminishing its percentage in the number of killed germs and its potency. He also replaced the vehicle generally employed, physiologic sodium chlorid solution, by an active substance in the shape of a solution of the same germs as those employed in the preparation of

the antipyorrhea vaccine. Such are the main features of this stock vaccine.

We must now pass on to a new phase of the subject which, in our opinion, is of the highest importance from the point of view of both positive results to be obtained and also precautions to be taken in order to avoid the complications which have been observed subsequent to the use of this biologic treatment. We mean to refer to the operative technic, as it has been laid down and practiced by us daily in our clinic at the *Ecole Odontotechnique.*

The instruments required are quite simple: 1. A drop graduated syringe, of 0.5 c.c. capacity. 2. A short, straight needle, of 0.2 mm. bore.

We make the following technical recommendations: First, we consider it of the highest importance that the injection be made very slowly on account of the high concentration of the vaccine. The more slowly the liquid is injected into the tissues, and consequently into the circulatory system, the more will our patients be protected against postoperative accidents, both local and general.

We shall draw a comparison between that phenomenon and what takes place when local anesthesia is sought with cocain and its derivatives.

Professor Reclus and his pupils Piquand and Dreyfus have shown that one of the important means of avoiding cocain toxemia (besides the use of a weak solution) lies in the slowness with which the injections are made. Toxicity is in direct ratio to the rate at which the alkaloid is introduced into the circulation; the experiments made by Piquand and Dreyfus have proved beyond doubt the truth of that statement. In our opinion, the same phenomena take place when an active substance such as Goldenberg's vaccine is introduced into the system. We therefore advise that the injection be made quite superficially, submucously, after a preliminary painting with iodin and drying. One must try to obtain a small bulla, a fluctuating vesicle on the gum as the result of the injection. The vaccine will then be slowly absorbed. That is the reason that we do not advise any pressure, any massage of the injected region after the withdrawal of the needle.

We are convinced that we owe to that technic the complete absence or infrequency of reactions, local and general, in the course of the treatment that we have practiced.

Another item is worthy of note: The injections should be begun at the seat of the pyorrhea lesions and where they are most pronounced.

Next, once the dose of from 2 to 3 drops is reached, it becomes necessary to divide the liquid to be injected between two or three regions in order to practice the "irrigation method" of Besredka, which gives the best results.

Finally, we think it useful to point out that the scale of doses, laid down by us in accord with Dr. Goldenberg, must on no account be modified except to be reduced, should a violent reaction command it.

The importance we attach to the technic of vaccinotherapy is confirmed by a communication from the pen of Dr. Drouet in *The Journal of Medicine of Paris,* from which we quote the following extracts:

> But on account, precisely, of the extension taken, and justly so, by the novel method of treatment, and on account too of the handiness and easy application of vaccines, certain medical men have come to overlook too easily the rules which should govern every rational attempt at vaccinotherapy.

By transgressing those rules, which have been known for a long time, one can encounter serious mishaps. Either vaccinotherapy gives no results or is attended with troublesome sequelae.

He also writes:

Those doses and the intervals of injection vary with each vaccine. That is why every laboratory takes the trouble generally to give precise indications regarding the use of the vaccines they prepare. Those indications must be followed by the practitioner. They must not be overlooked, as they have not been laid down haphazard but, on the contrary, follow the rules governing vaccinotherapy.

We shall now outline the results of four years' practice of vaccinotherapy in pyorrhea. In the course of that period, we have, several times, had the opportunity of showing to our colleagues patients successfully treated by us. We published the results obtained by us at Bordeaux, Brussels and Liege in the *Semaines Odontologiques* of Paris in 1925 and 1926.

We shall not dwell at length, today, on those statistics which have been published already on several occasions. We have, of course, had to treat cases of varying gravity. Some showed a local reaction only; some, a general and functional disturbance. In all of the cases, our treatment proved successful; partially, in some of them, and totally in the great majority. The improvement in the general condition, a fact of no small importance, was evident in every case. It was undoubtedly the result of the disappearance of suppuration and consequent pyophagia.

We have, besides, to call attention to the following results, both organic and functional.

1. Disappearance of suppuration, complete in most of the cases and occurring very early, often from the fifth or sixth injection. In most of our observations, even strong pressure about the necks of the teeth brought no pus.

2. Complete transformation of the gingival tissues, which recover their normal rosy hue, their original tone and a firmness indicative of their regained vitality. It is likely that local immunity brings about intimate changes in the state of the tissues, from which there results an improvement in the local circulation. That improvement is evidenced clinically by the fact that the brushing of the teeth and of the gums, which was an impossibility prior to the treatment, could be, in the end, performed easily, regularly and without pain.

3. The teeth regain their firmness. Those badly hit become less loose. We were impressed on observing, in certain cases, how complete was the consolidation of certain isolated teeth showing great recession of the gums and extensive absorption of bony tissue, in spite of their want of support, either proximal or distal. Unfavorable conditions as regards prognosis did not prevent the teeth from regaining great stability, allowing of a normal and absolutely painless mastication. We cannot then too strongly advise practitioners not to condemn teeth which, at first sight, appear so badly affected as to be past our help.

Such are the highly encouraging results which we have obtained on our pyorrhea patients by the use of gingival vaccinotherapy, applied, as we have already mentioned in conjunction with general treatment and with those local interventions necessitated by the state of the gums and of the alveolar process.

Those results have been confirmed and strengthened by the observations of Lebednisky, Bazin and Spalding in France, by the thesis of Jomini at

Geneva, and also by our colleague Dr. Dubeau, in the communication he made at Amsterdam in 1921 at the Congress of American Dentists of Europe. The dean of the University of Montreal concludes with the following words: "Goldenberg's vaccine is indicated and should be employed in all cases of suppuration in the mouth. Its action is evident and can be greatly beneficial to our patients."

Further, the first experiments made with that vaccine on this side of the Atlantic were equally interesting. We perused with interest the report of the Committee appointed at a meeting of the Miami Dental Society, Jan. 9, 1924, the report of the School of Dentistry of the University of Pittsburgh, dated July 15, 1924, and in the *Dental Cosmos*, the contributions by S. B. Luckie of Chester, and Theodore D. Casto of Philadelphia, and the remarks of G. C. Tassmann, S. L. Rosenthal and Lyman Missimer.

In Great Britain, H. Fielden Briggs conducted satisfactory experiments.

The happy results published by our several colleagues have strengthened our faith in the help to be derived from vaccinotherapy in the treatment of pyorrhea alveolaris.

II. VACCINOTHERAPY IN BUCCODENTAL INFECTIONS

Regarding the use of Goldenberg's stock vaccine in the various infective conditions of the mouth, we published the indications, and the operative technic in the *Journal Odontologique* of Paris in February last.

We have been applying it now for a long time, because we considered that if we had obtained such brilliant results in a chronic disease such as pyorrhea, we were justified in thinking that the ordinary affections of the mouth, caused by the germs usually found there, would be greatly benefited by the application of the same therapeutic methods.

There have appeared during the years 1924 and 1925, a series of articles by Duchange and by Pears on local vaccinotherapy in buccodental infections. We perused them with the greatest interest since, at the same time, we were conducting experiments on that subject, and their findings fitted in exactly with the admirable results obtained by us. We were, however, struck by one thing. In their contributions, the authors make no mention of the operative technic. My object will be to fill in that gap.

I must add, however, that, among the latest contributions on this question, the work of Gelly, and especially that of Reguart, have given instructions regarding the technic to be followed in certain special cases. Reguart had the idea of combining the different methods advocated by our confrères, making an addition of his own which we shall call the "vaccine dressing." You will see presently that we are in perfect agreement with him on that point.

The question to be answered is "Where and how should the injection be made?"

A novel conception of the mechanism of infection and of immunity we shall call the "Autonomy of the Organs." It becomes, then, of the greatest importance to carry the vaccine to the very seat of infection and this by means of appropriate instruments.

The armamentarium is made up of: 1. A drop graduated syringe (the same as that used for pyorrhea). 2. A short, straight needle, of 0.2 mm. bore. 3. A strongly curved needle of the same diameter. 4. A platinum needle,

very fine and long, and blunt at the end.

The following has been our technic in a variety of the infections most commonly met.

1. *Vaccinotherapy of Chronic Apical Abscess with Fistula Formation.*—Insert a very fine probe into the sinus. If the fistula is straight, use the short and fine needle. Follow the path of the fistula and inject 1 drop deeply at the first sitting. Withdraw the needle slowly and irrigate the path with vaccine. Increase the dose by 1 drop at each successive sitting.

In cases in which the path is tortuous:

A. If the external sinus is in the neighborhood of the infected apex, inject deeply without looking for the path, but trying rather to keep as near the apex as possible; the same procedure as in Case 1.

B. If the fistula tract opens away from the apex, proceed as in the radical cure of the fistula. Introduce the needle into the root canal and beyond the apex if possible. Plug the cavity with guttapercha or with temporary cement so as to prevent any back flow. Inject boiled water or physiologic sodium chlorid solution to clean the tract and to ascertain its permeability. Fix the syringe and instil the contents of one ampule of Goldenberg's vaccine, part of which will run through the external orifice. Remove the cement or guttapercha, withdraw the needle, insert a nonirritative dressing and put a provisional filling into the cavity. Repeat the operation every other day. Three or four sittings will suffice to dry up the fistula. The final stopping is only inserted after the root has been correctly treated and filled.

2. *Acute Circumscribed Abscess.*—If the abscess is in progress, make a deep injection with the small needle as near the abscess as possible. This is the best abortive treatment, the evolution of the abscess being stopped and the external evidence disappearing after two or three injections.

If, on the contrary, the abscess is completely formed and appears submucously, it becomes necessary to incise it so as to get rid of the pus. Next, inject the vaccine into the sound tissue nearest the abscess, but quite superficially, of course.

In the case of big abscesses, attended with loss of tissue, Requart's vaccine dressing is indicated.

3. *Chronic Abscess with Granuloma.*—Anesthetize locally the apical region, incise the mucoperiosteum, reflect it and trephine the alveolar wall. Apicoectomy is not required. Curet the cavity and instill an ampule of vaccine. Leave in a dressing. Two or three sittings will suffice. Cicatrization is extremely rapid. Root treatment is, of course, necessary.

4. *Rapidly Evolving Acute Pyorrheic Abscess.*—The principal feature of that kind of abscess is an extremely rapid evolution, attended by severe symptoms, acute pain and a temperature rising to 104 F. in a few hours. The abscess attains such size that it gives the patient the impression that it fills up the whole of the mouth. We have apparently to deal with an acute phase in the course of a chronic infection. Treated at the start, it is easily stopped by injections into the gum around the neck of the tooth and into the interdental space. The same procedure of 1, 2 and 3 drops is followed.

5. *Accidents Attending the Eruption of the Lower Third Molar.*—It is only necessary to inject the vaccine into the overhanging gum tissue.

6. *Septic Conditions Following Extraction.*—Use the vaccine according to the three usual modes of administration: (*a*) by instillation into the empty alveolus; (*b*) by leaving a vaccine dressing *in situ;* (*c*) by a superficial injection.

The few postoperative infective sequelae which we noticed in the course of our observations happen very seldom now. Whenever it is possible, we generally inject a drop of vaccine around the tooth to be extracted prior to making an extraction.

In the case of impacted lower third molars, when the operation is generally decided beforehand, we inject around the tooth 1, 2 or 3 drops of vaccine. However difficult the operation may be and however extensive the loss of bone, we have never noticed, in following this technic, any postoperative pain or infection.

We are not the only ones to follow this method; since 1924, L. R. Cohn of New York has recommended the use of Goldenberg's vaccine, as a preventive measure, before every extraction or buccodental operation.

CONCLUSIONS

The conclusions to be drawn are quite simple and are derived from the nature of the facts. Thanks to the work of Besredka and of Goldenberg, we now have at our disposal a fighting machine of such importance as not to be ignored by anybody.

In fact, the concentrated vaccine of Goldenberg is equally efficient against both pyorrhea alveolaris and all buccodental infections.

The technic, which is quite simple, consists (1) in the administration of progressively increasing minute doses; (2) in the instillation of large doses (without fear of any violent reaction), and (3) in the application of vaccine dressings when this is feasible.

By thus following this method of treatment, one rapidly dominates most of the infective conditions of the mouth where the classic antiseptics are without effect or require a long period of treatment.

DISCUSSION

Isador Hirschfeld, New York City: Dr. Frison, as well as other advocates of this vaccine, stipulates that the use of the vaccine must be accompanied by all operative procedures usually employed in the treatment of suppurative periodontoclasia. It is a fact well known to all of us that such operative procedures alone are usually sufficient to produce the desired results. How then does the lecturer measure scientifically the value of the vaccine as an aid in securing a healthy condition? In other words, how does he know that the vaccine had anything to do with the improvement of his patient? Ordinarily, the apparent return to the healthy appearance of the mouth after treatment, without the use of vaccine, is taken as an indication that the local traumatizing factors have been eliminated. Assuming that, in the treatment of a case of so-called pyorrhea, the additional use of the vaccine did raise the local immunity to the extent of overcoming the ill effect of incomplete operative procedure, the operator would have no means of checking up on the completeness of his work. Therefore, it is not to be expected that when the transitory immunizing effect that this stock vaccine is supposed to create commences to wear off, the remaining irritating agents must once more assert themselves and bring about reinfection. Dr. Frison does not mention the importance of a thorough physical examination of the patient prior to the use of the vaccine. Is it not a fact that in many patients, because of certain systemic conditions, the use of a vaccine, especially a stock vaccine, is contraindicated? Of eight patients, on six of whom I tried the inava vaccine with poor results, two were disqualified by the internists as risks for vaccine therapy.

N. G. Papantonopulos, Athens, Greece: I have tried the vaccine therapy in four or five cases and I have always had bad results, in

spite of the claims of the producers of this stock vaccine. The reaction was such, with chills and high fever, that we were compelled to stop the use of it in every instance. Probably this was due to faulty technic, although we followed the directions given us very closely. I should like to hear more from Dr. Frison.

CROWN AND BRIDGE WORK IN RELATION TO BALANCED OCCLUSION IN OPEN BITE CASES*

By THEODORE W. MAVES, D.D.S., Cleveland, Ohio

IN the study and practice of crown and bridge restorations and partial denture construction, we are confronted with cases which present a badly worn condition, with either all the teeth present or with the loss of certain members of the upper and lower arch, coupled with a worn condition of the remaining teeth. These problems present conditions most complicated and difficult to restore, owing, also, to the fact that the mandible presents a closed position to the maxillae.

In presenting this paper before the partial denture section, it is with a view in mind of bringing to light a few fundamentals which govern the underlying principles of the so-called open bite case.

I wish to call to your attention the great importance of a complete and thorough knowledge of the etiology, cause and effect of periodontal disease and also the effect of traumatic occlusion relative to restorative dentistry, because, without this knowledge, no one can be successful, unless he fully realizes his responsibility for the health of the underlying structures as well as the general health of the patient. May I suggest the literature and publications of the Academy of Periodontology. No doubt, most of us view the present-day periodontist as a tooth cleaner and scraper, but their research and present principles go so far beyond that theory that no one who today attempts to execute the principles of restorative dentistry can be successful without their added knowledge and cooperation.

A large portion of failures in bridgework, either fixed or removable, attributed to overloading of the abutments are directly due to the ignoring of the components of mandibular guidance. When we establish functional freedom in harmony with condylar and incisal guidance as required by each type of masticating unit, we shall have success in all our restorations.

Of all the cases that we are called on to restore to functional occlusion, the so-called open bite case is the most difficult, for, if all movements of the mandible are not recorded and successfully carried out in the occlusal anatomy, with all types of restorations, we will subject all restorations and the remaining teeth to disharmony and interference, resulting in lateral as well as vertical stress, bringing about periodontal disease and ultimate loss of the entire dentition.

*Read before the Section on Partial Denture Prosthesis at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 24, 1927.

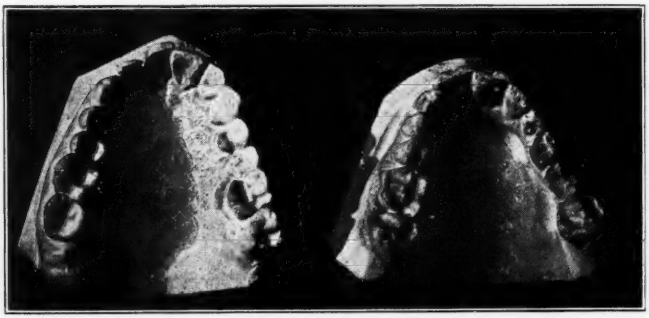

Fig. 1.—Case for restoration.

In a recent publication, Paul R. Stillman states:

It unfortunately happens, in many instances, that the position of the teeth or their cusp form is such that stress brought on them is far in excess of the presumptive capacity of the supporting tissues, or is at least out of proportion to the stress which is brought to bear on the other teeth in the mouth. Under such circumstances, wear of occluding surfaces may take place in such a way that the original stress is modified to an extent which brings it within physiologic limits, or reduces it to the level of the stress to which the other teeth are subjected. If such functional wear occurs, no harm will follow, and the stimulation of the surrounding tissues, as previously outlined, may take place. Such wear is seldom seen in the mouth of the average city dwellers of today.

It therefore follows that the element of excessive stress, once occurring in such a mouth, is continued indefinitely. As it is practically never self-limited, one of two things happens: First, given heavy alveolar support and high tissue resistance with disproportionate stress,

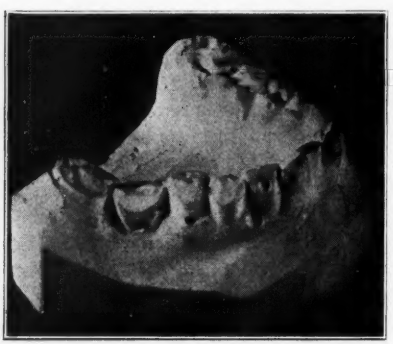

Fig. 2.—Case for restoration.

Fig. 3.—Plaster impression of upper jaw.

Fig. 4.—Piaster impression of lower jaw.

there occurs a disturbance of the pulp circulation, or, in the second place, given a less highly organized support with stress in excess of physiologic capacity, disease of the periodontal tissues ensues.

The *modus operandi* of these two dissimilar pathologic phenomena has its starting point in a disturbance of circulation of the pericementum.

This tissue, which has been overlooked by most students of periodontal pathology, with the notable exception of Box, carries within itself the explanation for most of the phenomena of periodontal disease and many of those of pulp pathology. When stress is brought to bear on a tooth, whether normal or excessive, its primary effect is on the pericementum. The compression and stretching of the pericemental fibers affects first of all the blood vessels. The primary result of this circulatory change seems to be the production of a hyperemia. In the type of tooth having a heavy alveolar support, this hyperemia has its most marked manifestation at the apex of the tooth. It affects the pulp circulation, extending to it also a hyperemia, if we may make a diagnosis by classic symptoms of dental pulp disease. This disturbance gives rise to sensitiveness, as, for instance, to thermal changes. It may go on to the production of acute pain characteristic of pulpal disease. It may, and frequently does, lead to death of the pulp. We are speaking here of teeth which present no caries and no advanced periodontal disease. The same prognosis can follow an individual restoration as well as a complete mouth restoration when teeth are present. Such cases are not a rarity in dental practice because of the absence of the better understood and more common exciting causes of such symptoms. Such teeth, if treated in time by the correction of traumatic occlusion, will rapidly

Fig. 5.—Modeling compound bite blocks.

Fig. 6.—Trimmed bite blocks.

become comfortable through the subsidence of the symptoms of inflammation.

In the other type of case mentioned, in which the alveolar support is inadequate, hyperemia seems to arouse the activity of bone-destroying cells, and alveolar resorption and rarefaction begin. As this occurs, there is a structural change in the pericementum, with usually a perceptible congestion of the tissues near the alveolar crest. The congestion results in lowered resistance, and possibly the entry of bacteria. With this event, the complex process of periodontal disease is under way.

It may be noted that, in both of these types of cases, there is excessive occlusal stress, which Nature has failed to relieve through the medium of attrition. In the first type of case, we have pulp disturbance owing to the fact that the periodontal tissues provide ample mechanical resistance against disproportionate, and therefore excess, stress. In the second type of case, we have periodontal disease because of the inadequacy of alveolar support, with pulp symptoms at a minimum. When we add to these two the types in which the capacity of the alveolar support is only slightly below the demand made on it, or in which the excessive stress is dissipated through natural wear, and in which the stress is thus brought within the capacity of the alveolar structures,

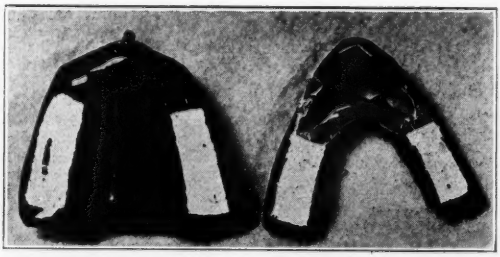

Fig. 7.—Bite blocks grooved, with carborundum and plaster placed within, to insure proper curve and adaptation.

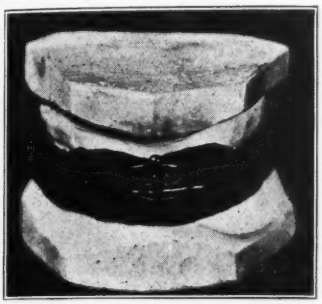

Fig. 8.—Cast showing tracing pin within modeling compound.

we have summed up the three fundamental results following on the introduction into the dental mechanism of the agency commonly called traumatic occlusion.

We can readily appreciate the foregoing as necessary to successful dentistry. Applying the results of the research which M. M. House has conducted, leading to the conclusion that the occlusal surfaces are in the form of arcs and curves and not planes, and by giving a small amount of freedom in central occlusion with the rotary grinder, we shall reduce vertical stress as well as periodontal disease resulting from this cause. The wearing of the contact surfaces and cusps of the teeth brings about proportionate changes in all parts of the masticating apparatus as well as in facial tissues and character of expression.

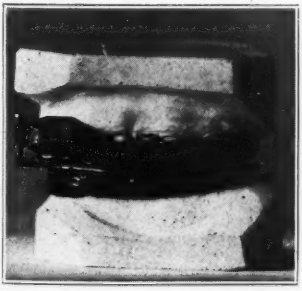

Fig. 9.—Cast with tracing pin shown in Figure 8.

Fig. 10.—Patient registering gothic arch tracing.

In a given case selected to carry out this technic (Fig. 1 and Fig. 2), the posterior teeth distal to the cuspids in both arches are to be restored to proper function; the anterior six teeth in both arches do not necessitate restorative work, and, therefore, will serve as our incisal guidance in protrusive movement, and the cuspids will react in a partial capacity in the lateral movement of the mandible. The reason for opening the bite in this particular type of case is to compensate the occlusal wear on the anterior teeth, and place all teeth in both arches in occlusal harmony and the best balance possible with the least amount of cusp interference.

When the case presented itself for diagnosis, the two lingual cusps of the

Fig. 11.—Right and left lateral wax bite of yellow beeswax.

two upper bicuspids were fractured from occlusal wear and the lingual roots of both upper first molars were denuded of process one-third their length, owing to terrific occlusal wear and elongation to remain in occlusion, with periodontal disease on the mesial side of both upper first molars and also the anterior six teeth, the latter being due to anterior leverage.

Assuming that the case at hand has been successfully diagnosed and treated for the removal of all infection and the remaining tissues have been placed in a state of health, we make study models of artificial stone and mount in an articulator for the study of cusp interference and trauma on the remaining teeth before any restorations are made. The relief of any tooth or teeth functioning in traumatic occlusion or cusp interference is very important at this time, because, if this is not accomplished, the particular tooth or teeth will continue to function in traumatic occlusion after the restoration is made as it has before the restoration was attempted. This applies as well in cases in which the bite is not opened. The grinding of certain points and surfaces of the teeth is best accomplished by following the technic recommended by Dr. Stillman and others.

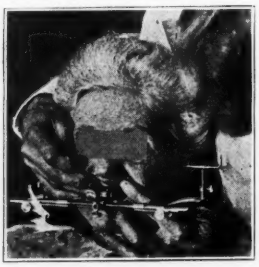

Fig. 12.—Establishing condyle path tracings.

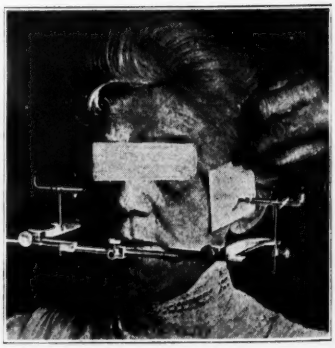

Fig. 13.—Establishing condyle path tracings.

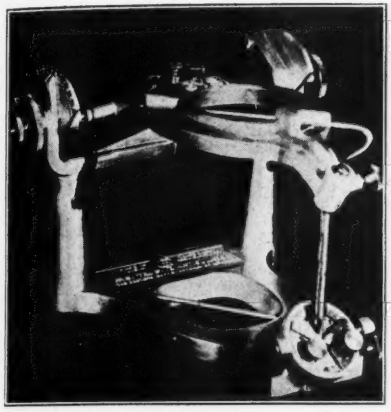

Fig. 14.—Case mounted in articulator.

By carrying out the foregoing principle in certain types of cases, we are enabled to build on the occlusal surfaces of those teeth on which it is necessary without increasing the length of the crown of the tooth to such a degree as to increase lateral as well as vertical stress, which is detrimental to our restorations.

After the relief of cusp interference, we proceed to the necessary cavity preparations in four teeth in the lower arch, selecting the two lower second bicuspids and two lower second molars. After their completion, we select four opposing teeth in the upper arch and proceed to make the cavity preparations on the upper teeth to carry out the plan of repairing the occlusal wear.

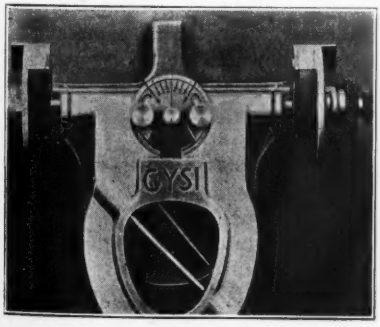

Fig. 15.—Lateral control set with small plates midway between the condyle heads.

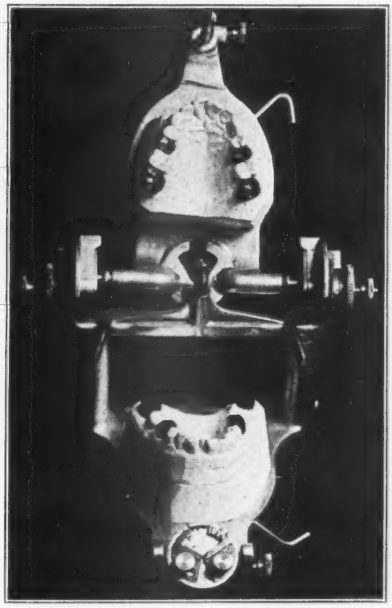

Fig. 16.—Waxing abutments.

The next step is to determine the distance the bite must be opened to obtain the best balance possible and functional occlusion harmonious to all the movements of the mandible. Fundamental in opening any bite is the establishment of the correct relationship of the mandible to the maxillae at the required distance. If the central relationship is not registered by the patient, and the operator proceeds to build his case with no accurate starting point as re-

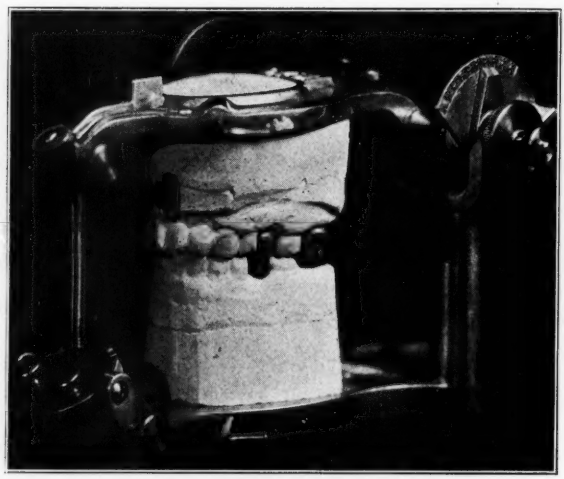

Fig. 17.—Cast transferred to articulator.

gards central relationship, all the occlusal anatomy of the entire restoration is placed in disharmony, and periodontal disease, with failure of the case, is a result.

The greatest number of our failures in open bite crown and bridge, and partial as well as full denture, construction have resulted from the lack of this knowledge and failure to record this fundamental. In cases of crown and bridge restorations, when no attempt has been made to incorporate this principle, we have introduced traumatic occlusion rather than relief of the condition, and disease of the underlying structures resulted in time, with great discomfort and lack of proper mastication for the patient.

Up to the present time, there are two methods which have proved a success in recording the central relationship of the mandible to the maxillae: the first known as the gothic arch tracing, given to the profession by Dr. Gysi of Switzerland, and the second, known as the Needles method, given to the profession by Dr. Needles of Colorado, employing three pins placed in the upper modeling compound bite block, registering three tracings in the lower and establishing three important fundamentals: namely, central relationship, lateral movements of the mandible and condylar inclination harmonious to the case.

This essay will deal with the first method known as the Gysi gothic arch tracing, and I also wish to recommend the writings and principles given the dental profession by Dr. Gysi in regard to mandibular movements, their registration by the extra-oral method and also his technic; for no one of his theories or principles given has been disproved, and very often they have been misunderstood by some of the profession.

Having completed in the mouth the cavity preparations on the eight teeth

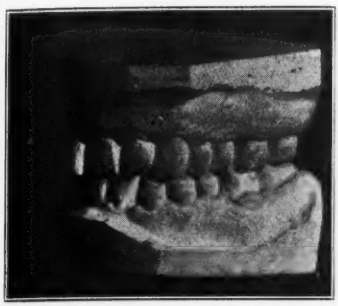

Fig. 18.—Completed case.

previously mentioned, we make amalgam models. We now proceed to take a shallow plaster impression of both the upper and the lower teeth, as indicated in Figure 3.

The eight amalgam dies are now placed in their relative positions in the plaster impressions, and artificial stone casts are made from them. Modeling compound bite blocks are made over the occlusal surfaces of both upper and lower casts, as shown in Figure 5.

The thickness of modeling compound placed on the occlusal surfaces is a little greater than the distance that the case is to be opened. These bite blocks are trimmed in the anterior six teeth to extend through, as shown in Figure 6.

Because in this given case, with the present overbite, no restorative work is necessary on the anterior six teeth, and they are to be used as our incisal and cuspid guidance, the posterior portion of both bite blocks are grooved, and carborundum and plaster placed within, as shown in Figure 7, so as to be milled to proper curve and adaptation on both the right and the left side in the mouth and also to the proper distance of opening required in the individual case for balance. We now proceed to the mouth and place both bite blocks in position, instructing the patient to perform right and left lateral movements of the mandible, milling in the case to the proper distance required to be opened and to occlusal contact on both sides. The blocks are removed and placed on the casts, and the small plate is placed in the anterior region of the lower teeth, the anterior teeth being allowed to extend through, with an extension anterior to the lower incisors for registration of the Gothic arch, as shown in Figure 6.

In the upper denture, a small tracing pin is placed within the modeling compound extending on the labial surface of the upper anterior six teeth as shown in Figures 8 and 9.

Black wax is now placed on the extension of the lower plate to allow a tracing to be made. (Fig. 6.)

The blocks are now placed in the mouth, the patient having been previously instructed in regard to performing the movements of the mandible. The patient now registers the Gothic arch tracing on the lower plate by means of the pin in the upper shown in Figure 10, thereby establishing the central relationship of the mandible to the maxillae, and also registering the right and left lateral movements of the mandible at the required distance necessary to open the case to establish balance.

After this procedure, a right and left lateral wax bite is now made of yellow beeswax. (Fig. 11.)

In obtaining the lateral control of the condyle paths, known as the Bennett movement, care should be exercised to have wax bites made with the pin on the line of the lateral tracing of the Gothic arch. We now establish condyle path tracings of both sides by placing the Gysi face-bow in the bite block and using a card with a pencil trac-

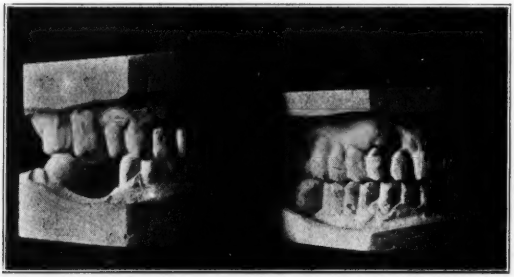

Fig. 19.—Case before and after correction.

ing as shown in Figures 12 and 13. These tracings can be easily and accurately made and quickly verified by making a number of tracings of each side to prove and check the proper condyle inclination necessary. The Gysi face-bow having been inserted in the sides of the upper modeling compound bite block; having sealed the two bite blocks in proper central relationship, and withdrawing both bite blocks and face-bow from the mouth, we now mount the case in Gysi trubyte articulator, as shown in Figure 14.

We mount the upper cast by means of the face-bow, transfer the condyle path tracing from the card to the articulator on both sides and then mount the lower and the upper cast in central relationship.

The right and left lateral wax bites are now placed on the bite blocks and the Bennett movement or lateral control of the condyle paths is set with the small plates midway between the condyle heads. (Fig. 15.)

Following the foregoing, we adjust the right and left guide plate, starting from the point of Gothic arch tracing or central relationship. The central point of the tracing will be known as central occlusion in the new position to which the case is to be restored.

To summarize: The foregoing steps as transferred to the articulator are as follows:

1. The upper and lower casts maintained in central relationship are mounted on the articulator by means of the face-bow.
2. The inclination of both condyle paths is recorded from the card tracing.
3. Bennett movements of condyle paths are recorded by means of right and left wax bites.
4. The central relationship and the right and left movements of the mandible are recorded on the incisal guide plate.
5. Overbite and incisal guidance are maintained by the remaining anterior upper and lower teeth of the case.

Having recorded the necessary movements within the distance required to establish balance and function, we now remove the bite blocks from the casts in the articulator and proceed to wax up the eight abutments shown in Figure 16.

The occlusal anatomy is now carved to functional occlusion, harmonious to all movements of the mandible, and transferred to the articulator from the patient. By the different movements of the articulator, the cusps, marginal ridges and all the occlusal anatomy is

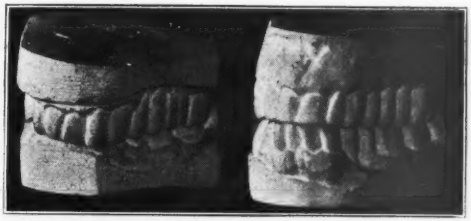

Fig. 20.—Case before and after correction.

placed in harmony with central relation, right and lateral movements, incisal guidance and condyle paths, thereby practically eliminating lateral interference as well as vertical stress in the occlusal carvings as best the case permits. (Figs. 16 and 17.)

The wax patterns are now removed, invested and cast, and fitted on the amalgam dies, then placed in the articulator.

A most important fundamental to incorporate in the occlusal anatomy is functional freedom in central as well as lateral occlusion. This can be obtained by the use of a House rotary grinder, placed on the upper bow of the articulator, and the use of carborundum powder mixed with adhesive powder.

Since the occlusal surfaces of all teeth in all stages of wear are in the form of arcs and curves, as definitely proved by M. M. House, and 75 per cent of all restorations, including inlays, crown, bridges and partial as well as full dentures, are made with occlusal interference and trauma is introduced rather than relieved, it is most important to establish this freedom in occlusal surfaces. This can be most successfully accomplished without destroying the occlusal carvings, given lateral as well as vertical freedom in central occlusion, which is so important in the maintenance of the health of the periodontium as well as the relief of traumatic occlusion.

Owing to the fact that articulators are just a means to aid in obtaining a desired result, provided the proper registrations have previously been made by the patient and recorded on an articulator made to function in accord with these registrations, we now place the eight abutments in cast form on the teeth in the mouth for a final check up, having the patient perform all functional movements, and, if necessary, we regrind to correct any slight interference noticeable; this being a matter of checking up any slight errors of the articulator as well as of registration and transfer.

From this point, we proceed to restore the remaining teeth necessary, having established eight abutments as our guides, with the occlusal anatomy functioning in harmony with all the movements of the mandible; thereby restoring the teeth of the mandible to proper function and having the highest regard for all underlying structures whose maintenance of health and function should be one of our most important accomplishments. Figure 18 shows the completed result of the case carried through with this technic. It has proved more satisfactory, and given greater comfort to the patient than has occurred in many past cases at-

tempted with other methods. Figures 19 and 20 represent practical cases, before and after completion, affording the best balance possible with the existing conditions.

I wish to express my appreciation for the principles, teachings and inspirations derived from Drs. Gysi, House, Needles, Box, Stillman, Hood and others, and hope to afford some slight benefit to those following this specialty in dentistry.

DISCUSSION

DeForest Davis, Minneapolis, Minn.: This is a subject with which every prosthodontist must be thoroughly familiar if he would render the finest possible service. Although much progress has been made during the last eight or ten years toward a better understanding of the principle and method of complete dental reconstruction for the correction of the relation between the mandible and the maxilla, no man is yet qualified to speak conclusively on the subject. We still have much to learn. I make this last statement advisedly after several years of personal experience as well as intensive study with the Monson Research and Clinic Club of St. Paul. This group demonstrated to itself some time ago the truth of the expression that the more we learn, the less we think we know. We thought, when C. K. Bird developed his technic for complete dental reconstruction, based on Dr. Monson's research, and using his (Dr. Bird's) balanced occlusion guide, occlusal blocks and positioning tie, that the whole problem was pretty well solved. We found, after some experience, that even a complete, well organized method, carefully applied, will not of itself insure success. Primarily, success here depends on a broad knowledge of the etiology of the condition that we are attempting to treat. For this reason, we, the members of the Monson Club, have given most of our time, during the past two years, to a study of such subjects as dental embryology and the architecture of bone and its relation to the forces of muscle function, as well as changes in bone as a result of changes in degree and direction of muscle pull. This work was done under the direction of teachers from the School of Medicine of the University of Minnesota, in an effort to answer the question: What changes, physical and functional, may occur as teeth are lost or abraded? We believe that such questions as this are of primary importance, because they involve etiology, which is the foundation of diagnosis. I regret that Dr. Maves only mentions diagnosis, because the technic he describes will be of little value unless he tells us how he determines what has happened, what caused it and what may be done to remove the cause and bring about a correction. On page six, he says: "The next step is to determine the distance the bite must be opened to obtain the best balance possible and functional occlusion, harmonious to all the movements of the mandible. A very important fundamental in opening any bite is to establish the correct relationship of the mandible to the maxilla at the required distance necessary." He is quite right: the new relation between maxilla and mandible is the all important factor in this work. For this reason, the determination of the amount of change necessary is of great importance, and I regret that Dr. Maves omitted a description of this step. No doubt, this was done inadvertently, because I am sure that he would agree that so important a part of this procedure should be described in great detail. Opening the bite is only a means to an end. The end or purpose is to correct the relationship between mandible and maxilla, thereby promoting the health and efficiency of all structures which are related to dental function. So do not get the idea that the bite must always be opened. I might mention also that closure is not the only malposition which the mandible may assume. Frequently, we encounter lateral and anteroposterior deflections, usually combined with closure, and often seriously complicating the treatment. I refer particularly to the Class 2 and Class 3 conditions as treated by the orthodontist. I want to compliment Dr. Maves on the stress he has laid on the matter of correct central occlusion. However, there is ambiguity as regards the idea that he seems to have in mind. In the case presented, he has opened the bite presumably to correct the relationship between mandible and maxilla, but I am unable to determine whether he wishes to perpetuate the original central occlusion or establish a new one. On this point, he says: "If the central relationship is not registered by the patient, and the operator pro-

ceeds to build his case with no accurate starting point, as central relationship, all the occlusal anatomy of the entire restoration is placed in disharmony, periodontal disease following, with failure of the case as a result." As I understand it, central occlusion is registered when the jaws are closed in central position, but Dr. Maves makes his tracings and does his milling with occlusal blocks in place. These, of course, open the bite and take the entire mandible out of its habitual path. It is my opinion, therefore, that the tracings made by this method are not accurate records of the patient's habitual movements, but are records of new movements inaugurated by the occlusal blocks. It is my opinion also that if the height or arc of the blocks were changed, the tracings would also change, this proving that condyle path tracings are of little value in this work and mandibular movement is guided principally by the occlusion and not by the condyle path. This statement can be further substantiated by observing in our practical cases the extreme malpositions the mandible does assume when many teeth are lost. In connection with this point, the anatomic dissections by Dr. Prentice of the University of Iowa, showing the results in the glenoid fossae of extensive dental mutilation are of particular interest.

C. K. Bird, in his paper read before the Winter Clinic at Dallas, Texas, January, 1927, says: "The evidence indicates that the condyle path is changed or altered as the occlusion changes, that the path is the result of the occlusion, that the occlusion guides the condyle and if the occlusion is corrected, the condyle will take care of itself because bone is a living structure accommodating itself to the stresses put upon it." For these reasons, it is our practice to make no records of the inclination of the condyle path in our reconstruction cases, but diagnose, plan and make our restorations toward an ideal, using as our guide the spherical principle of occlusion as taught by George S. Monson. Dr. Maves states that study models are first made and mounted for the purpose of studying cusp interference and trauma before any restorations are made; also that the relief of any tooth that functions in traumatic occlusion is important at this time because it will continue to function in traumatic occlusion after the restoration is made. He also states that this applies as well to cases in which the bite is not to be opened. I can readly agree with the last statement, but it seems illogical to me to relieve cusp interference on teeth which are to be immediately built up to an entirely new relationship. In his title, Dr. Maves uses the term "open bite case." At first thought, one is led to the conclusion that he is going to present a case that has developed in the eruption of the teeth to an open bite relation, i.e., one in which there is occlusal contact in the molar region only, owing, possibly, to lack of development of the ramus of the mandible, or the base of the cranium. The case that he does present should be called a closed bite case, because it requires opening; although even this term is not satisfactory. There is much to be done in the way of classification and nomenclature in this branch of our work. I wish that Dr. Maves had made clearer his meaning of the term "vertical stress," which he says is reduced by the use of the rotary grinder. It is my understanding that vertical stress is applied only when the mandible is in position of central occlusion, and that the principal deforming force is that applied when the mandible moves from central occlusion when malocclusion is present. Strictly speaking, we cannot "reduce" any occlusal force except by telling the patient not to bite so hard. However, we can distribute occlusal force over the entire dental arch, and this is what we do when we use the rotary grinder and similar devices. I am glad to hear Dr. Maves stress the importance of a knowledge of periodontal disease and its relation to our work. There is undoubtedly an intimate relationship between periodontia, orthodontia and prosthodontia. The same principles apply to all three branches of our profession. It is my opinion that the prosthodontist cannot render a complete service until he is able to recognize in their incipiency conditions requiring treatment by the periodontist. The highest aim of the prosthodontist should be the health of the investing tissues. This involves an intimate knowledge of periodontal disease, its etiology and treatment. The method used is not always of great importance. It is important that the dentist should have an intimate knowledge of the fundamental factors which apply to his work. At the present time, there is much to be learned about the etiology of these perplexing deformities, such as the one described by Dr. Maves.

Treve Jones, Portland, Ore.: I wish to call attention to the nice distinction that Dr. Maves made between the irritation of the pulp and the disturbance of the periodontal membranes. We have all had our grief in trying to relieve trauma, and some of us haven't understood that very nice distinction.

Dr. Maves (closing): I am sorry that I did not receive a copy of Dr. Davis' discussion so that some of the points of difference could be clarified. A broad knowledge of the etiology, cause and treatment of this condition is greatly desired, but since a separate paper would be required to cover this phase, I have confined my remarks to the technic. In presenting a technic which would be of practical value we can be guided only by principles which have proved a basis of success from a practical standpoint. I know of no sounder fundamentals than those given us by Dr. Gysi. This has also been proved by the findings of the National Denture Prosthesis Society. The same fundamentals should be carried out in open bite cases of crown and bridge work as have proved practical in full denture cases, with but slight differences. I would recommend as a basis of further study the research work of Dr. Gysi and others which to date have been proved a success and are accepted by most of the profession. As regards vertical stress: the research work of Dr. Gottlieb of Vienna emphasizes the great importance of correct vertical stress on natural teeth as well as in all restorations placed on natural teeth. This principle has well been accepted by such men as Dr. House and also by the majority of men who practice periodontia. Since, in the human race, we have a great variation of different types and forms due to interbreeding and all lines of symmetry present a great variation in the different individuals and are not concentric to one type, it is quite impractical to build the structures of the cranium to one spherical principle which should apply to all different forms and types, in an effort to obtain a so-called ideal in occlusion. The greatest point of difference which Dr. Davis made pertained to the occlusion; namely, that the cusps, arcs and curves of the occlusal restorations were the guiding factor of the mandible and that an arbitrary condyle path could be established and corrected later. It is a recognized fact in denture construction that when dentures are made with an improper relation of the mandible to the maxillae in central relationship or improper central occlusion in the new position, we have absorption of ridges, ill-fitting dentures and many other evils due to wrong direction of forces caused from such construction. We can multiply this destruction many fold on natural teeth carrying restorations and the underlying structures when the foregoing principle is not applied. Let us now consider a case where the bite is opened and the mandible is advanced, building the case to establish an arbitrary condyle path allowing the occlusion to be the main guiding factor to obtain the best possible balance.

A MODIFIED APPARATUS FOR THE TREATMENT OF THE CASES CLASS II (ANGLE)*

By MORIZ TISCHLER, M.D., Vienna, Austria

THE characteristic signs of the cases of Class II (Dept. 7) (Angle) are: a distal occlusion of both lateral halves of the lower mandibular arch, an underdevelopment of the lower jaw and an elongation of the upper and lower front teeth, with protrusion of the upper incisors. The musculature of the lips and cheeks is forced to function abnormally because those troubled with this anomaly are mouth breathers.

In the treatment of such cases, we shall therefore make use of such means as are fitted to correct the development

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of those muscles whose function has been disturbed by mouth breathing; meaning, aside from the apparatus, the muscle exercises of Rogers. But an important obstruction in the Rogers' exercises for the development of the orbicularis oris group is the expansion arch by which the intermaxillary ligatures are carried. In standing out from the front teeth as far as it does, it forms a barrier, as it were, between the cheek, the lips and the teeth, and thus must check the free movement of the upper lip and force it into an unnatural position. For this reason, it was appropriate to look for a modified apparatus possessing all the original value but not these advantages of the expansion arch.

I wish to give a succinct description of the modified apparatus that I have been using for some time with unvarying success. The essentials of every treatment, as you know, consist in using all the teeth of the upper jaw as an anchorage from which, by means of rubber rings, the teeth of the lower jaw are brought forward.

The cuspids are connected with the molars by means of a palatal wire and with each other by means of a labial wire. The expansion arch, which extends from the buccal tubes of the molars, carries the intermaxillary ligatures.

In the modified apparatus, the expansion arch is dispensed with, the teeth of the upper jaw are joined into a fixed system and rubber rings are carried on the cuspids. What we wish to preclude is the possible extraction of these cuspids by the traction of the rubber. We shall therefore have to take especial consideration of this point in the construction of the apparatus.

There are molar bands of 20 carat gold-platinum, 0.006 inch thick; for all other teeth, 10 per cent platino-iridium bands, 0.157 inch broad and 0.003 inch thick. With these bands in place, an impression is made and cast, and both the cuspid bands are connected labially on the one side with each other by means of an 0.03 inch thick platino-iridium wire, and on the other side with both the sixes by means of a buccal 0.04 inch thick wire.

A small anteriorly open hook is then soldered bucco-distally onto both cuspid

Apparatus in place.

bands in order to receive the intermaxillary rubber rings. To preclude extraction of the cuspids, spurs of 0.02 inch thick platino-iridium wire are soldered immediately under the corresponding wire connections on the four incisor bands as well as on the four bicuspid bands.

Thus, extraction of the cuspids would be possible only with a simultaneous elongation of all the other teeth.

In consideration of the difficulty of placing an apparatus covering the entire upper jaw in at one time, one can help oneself by the following method of Grünberg's: Only both cuspids and the left molar are firmly attached to each other. The right molar receives a distally closed buccal tube into which the buccal wire of the cuspid projects. The immovably soldered bands are then first cemented, after which the buccal tube is pushed under the wire and the molar band fixed with cement.

For the lower jaw, the well known Grünberg apparatus was used.

In consideration of the shorter distance between the cuspid hook and the lower molar band, one must use smaller rubber rings with an external diameter of 0.25 inch and an internal one of 0.12 inch.

It is perhaps superfluous to add that this apparatus permits only of mesial displacement. Extension of the jaws, movement of single teeth, etc., demand the installation of other apparatus, which cannot be considered here.

The accompanying illustration shows the apparatus in place.

PROGRAM FOR THE SCIENTIFIC COMMISSION OF THE INTERNATIONAL DENTAL FEDERATION*

By BERNHARD GOTTLIEB, †Vienna, Austria

THE purpose of the Scientific Commission of the International Dental Federation is to carry on the scientific work of the international congresses, which meet every five years. The reasons for this are twofold: it is dedesired (1) that between the congresses as close a contact as is possible be maintained between the investigators of different countries, and (2) that the differences of opinion held by various investigators should be continually cleared up so that the public debates at the congresses may be free from all misunderstandings and give a clear picture of the different opinions extant.

The Commission for Scientific Research shall meet every year simultaneously with the International Dental Federation. The national committees shall choose the permanent members of the commission. Besides the standing members, any investigator who is introduced by a member of a national committee or invited by the commission may participate in the meeting.

Any investigator in dentistry wishing to bring any subject up for discussion at the next meeting of the commission must inform the chairman of the commission in good time beforehand, and at the same time he should inform him whether he wishes any particular investigators from other lands to be invited. It shall be the duty of the chairman not only to send out the desired invitations but also to give notice

*Read before the Section on History, Science and Libraries at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 26, 1926.

†Chairman of the Committee.

in the dental journals of the points which will be discussed.

In the first general meeting of the commission, it will be definitely settled on what questions there are sufficient members wishing to speak concerning their research work for a subcommission to be set up. It will further be settled what questions are to be discussed in united subcommissions and what questions in the full meeting of the Scientific Commission. Each subcommission will choose a chairman and a secretary whose duty will be particularly to prepare a report for the final sitting of the Scientific Commission. Following the reports in the final sitting, short discussions will take place. The commission will publish every year a general report giving the whole profession throughout the world a general view of the existing conditions of research. According to results of the meetings of the Commission, the principal subjects and their speakers at the Congresses can be chosen.

Besides these reports, it shall be the duty of this commission to bring into the foreground the most pressing questions of our profession and to recommend particular questions for study, and possibly to propose to the International Dental Federation the offering of prizes for the solution of particular problems. It would further the development of dentistry if research workers were to place their material at the disposal of others. The institute of dentistry in Vienna, for instance, has histologic material, especially from human beings, in an amount which is surely not often to be met with. Possibly in other institutes, special facilities are to be found for chemical, bacteriologic or other work. The heads of all dental institutes throughout the world may be invited to make known the special facilities which they can offer in order to promote international collaboration in research work.

In the United States and in Germany there are bibliographies which are completed from time to time. It would be advisable to enlarge these indexes so that they will comprise a world index, perhaps omitting the literature, which is unquestionably worthless. Each national committee is to undertake the compilation of that part of the work relating to their respective countries. For carrying out the work, the commission on documentation might be suggested.

SOME FUNDAMENTAL PRINCIPLES OF REMOVABLE REGULATING APPLIANCES*

By VICTOR HUGO JACKSON, M.A., M.D., D.D.S., F.A.C.D., New York City

THROUGH the Section on Orthodontia, I am privileged to present another chapter, calling to your attention the advantages of the Jackson system of removable orthodontic appliances.

In reviewing broadly the fundamental principles involved, in detail, we note that about 35 per cent of humanity suffer from nasal stenosis, lack of nasal space, and it is desirable that we here first consider fully the main purpose and uses of an orthodontic appliance.

This leads me to include in this report a brief and thorough plan of personal examination, diagnosis and treatment of the patient, especially of the young child. I am continually presenting these thoughts in my child welfare teachings. The child, when very young, should be examined thoroughly at intervals and, from the survey made, especially of the dental arches, any detrimental variations from a normal development of the bony frame should be noted. Thus, if the dental arches are abnormally narrow, the floor of the nose being the roof of the mouth, nasal stenosis will result, the degree of stenosis corresponding to the degree of encroachment on the nasal space.

When this narrow condition of the maxillary arch exists, it is the mission of those of our specialty to prevent nasal stenosis by increasing the nasal space through early orthopedic treatment.

We are mindful that we, the orthodontopedists, are now the only specialists prepared to assist Nature in developing normal nasal space. This is so plainly manifest that it cannot be questioned.

In the egg is the whole chick. Nature defines how much bone shall be distributed to each developing part of the bony frame of the chick. This fact helps us to understand readily that, in the plan of development of the dental arches of the child, a normal amount of bone is to be added to the edges and body of the palatal processes, when the child is very young. Through research, I was early convinced of the fact, that, with the narrow maxillary dental arch of the child, the palatal vault, formed by the processes through their development at the sutures, reaches abnormally high into the nasal space, and presses upward on and deflects the septum of the nose, at the same time encroaching on the turbinated bones, which are an associated source of all degrees of nasal stenosis; and that condition, without the early orthopedic treatment of the patient, would continue through life.

DIAGNOSIS FOR THE CHILD

When the child's maxillary arch is abnormally narrow, the palatal processes, in development, gradually extend higher in the vault and encroach detrimentally

*Read before the Section on Orthodontia at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 26, 1926.

on the nasal space, which causes stenosis. This condition should be cared for in the child or prevented through early

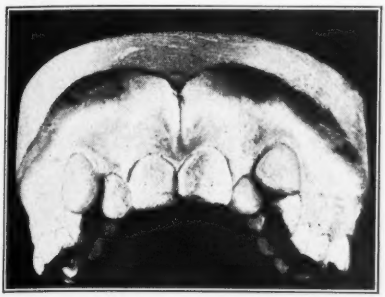

Fig. 1.—Diagnosis for adult: these prominent cuspids should be made more prominent to provide space for four incisors in normal line.

orthopedic lateral expansion of the dental arches as early as at 3 or 4 years, in extreme cases, while the bone is less dense and more plastic, the palatal proc-

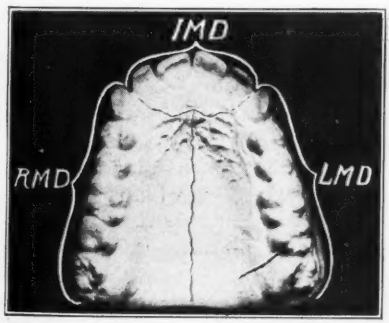

Fig. 2.—Right and left maxillary and the intermaxillary divisions of the palatine arch and the suture lines of development.

esses being prevented from encroaching on the nasal space. With this there will be no discomfort, and treatment may be continued as necessary.

Accordingly, in case of an abnormally contracted arch, effective expansive treatment should always be carried

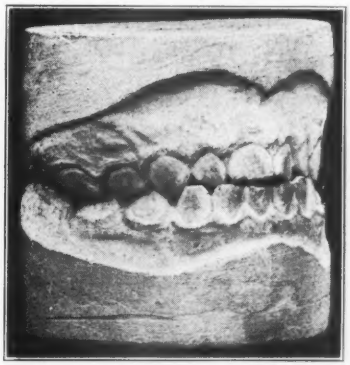

Fig. 3.—Occlusion of child, aged 4 years and 7 months, with abnormally narrow arches and deficient nasal space.

on before 6 years of age, to bring about a normal increase of nasal space and to assure full space for the permanent in-

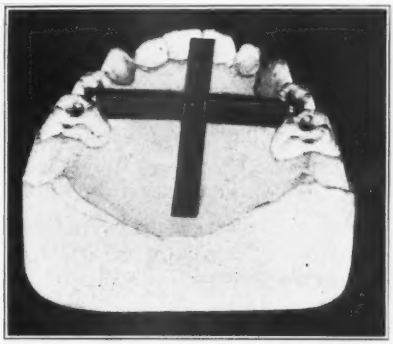

Fig. 4.—Cast with measuring gage, showing depth of palatine vault from line of the gingival borders of the arch (15 mm.).

cisor teeth to erupt in a normal position.

To diagnose the contracted arch condition as referred to, the most simpli-

fied plan for physician, dentist or orthodontist is as follows: Every child 6 years of age or younger, should have sufficient space between the deciduous

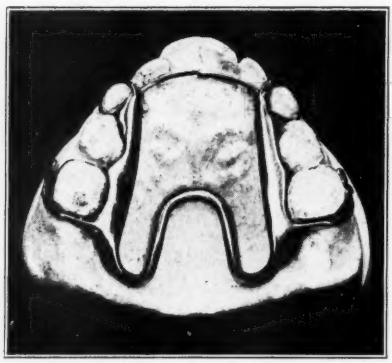

Fig. 5.—Cast and appliance having body and arms anchored with wire clasp locking device, used to gradually expand the child's abnormal, narrow maxillary arch laterally.

cuspids, upper and lower, to accommodate freely four permanent incisor teeth, either from normal development or as a result of expansive orthopedic treatment.

Parents should be made to realize that these permanent incisor teeth will never be any larger than when erupted.

DIAGNOSIS FOR THE ADULT

It is very important that we simplify and improve our plan of general diagnosis of the condition in adults for orthodontic treatment of any abnormal arch development and occlusion, including insufficient nasal space (Fig. 1).

With this in view, in diagnosing a case, with care one can, by direct vision, without measurement, as he looks in the mouth of the patient of any age, determine whether there is sufficient space between two permanent cuspids, to accommodate freely four permanent incisor teeth, with the cuspids, bicuspids and molars in arch line.

These permanent cuspids may be very

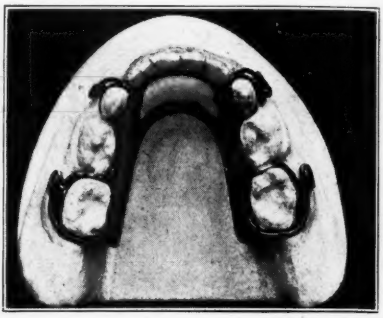

Fig. 6.—Cast and appliance anchored with locking device for expanding laterally the lower dental arch.

prominent and yet not be prominent enough, as shown, to permit the four incisors to take their normal position between the cuspids, when the cuspids need to be made more prominent.

First Molars.—To be concise, when the boy is about 6 years of age, his first permanent molars are erupted. They are permanent teeth and the parents should be told that they are adult size; that they have been developing since early infancy, and will never be any larger than when erupted, and that they should be carefully cared for all through life.

Incisors.—When the boy or girl is 7 years of age, the permanent upper and lower incisor teeth should have erupted. Furthermore, it should be understood that, under each of the remaining deciduous, or temporary, teeth there are permanent teeth developing which will erupt, after Nature's plan.

With all these facts before us, Nature, from this, definitely shows us that

she is trying to establish an adult normal arch, as should be, for the child, very early.

It is at this time, in the case of a narrow maxillary arch, that the dental

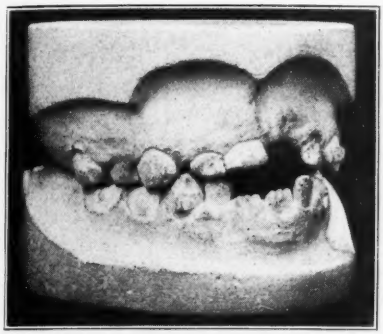

Fig. 7.—Result of plan of child diagnosis, referred to, which provides normal nasal space through early lateral expansion of the arches, sufficient to accommodate four permanent incisor teeth between the two deciduous cuspids.

orthopedist can assist Nature most in establishing free normal nasal space; that is, treat the child early, as we do in reshaping a young vegetable plant, not waiting till it becomes a tree.

With these conditions before us, it is extremely important that all of our profession should, in educating the public, use these ideas as a slogan in the cause of child welfare.

Again, with these conditions before us, in consultation, it is the duty of the physician, orthodontist or dentist, to describe earnestly to the parent the details of treatment, pointing out the necessity, when required, of broad arches to provide sufficient nasal space for the adult. This careful explanation to all parents would promptly convince them of the advantage and necessity of arch expansion, and tell them that these teeth should be continually watched and cared for all the child's life.

This knowledge would also relieve a parent of any idea of suspicion of the

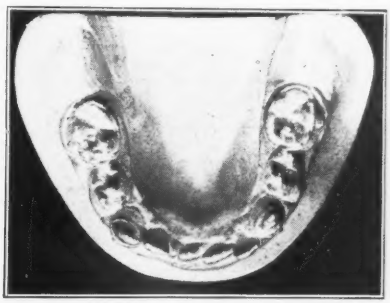

Fig. 8.—Permanent incisor teeth erupted about two years earlier than considered normal, resulting from early lateral expansive orthopedic treatment. The early eruption of permanent incisor teeth is also shown in Figure 7.

specialist's purpose, convincing them that this plan is required for the child's welfare.

It is so important for the parent to know this that the specialist should often repeat that, should the maxillary arch be too narrow to freely accommodate the permanent teeth, the palatal processes (which are to consist of a certain amount of bone) will project upward more into the nasal space, as we have described, through their development, effecting the crimping of the septum of the nose and interfering with other tissues, a condition that a considerable percentage of persons are seriously afflicted with. The defined narrow arch would cause other nasal obstructions, perhaps a diseased condition, and the lack of space would always bring about an abnormal arrangement of the teeth. By providing

a broad arch early, as here planned, the palatal processes would not develop abnormally upward, increasing the depth of the vault unusually, or encroach on the nasal space, but rest in normal position, broadening and increasing the nasal capacity, and thus insuring a normal nasal space.

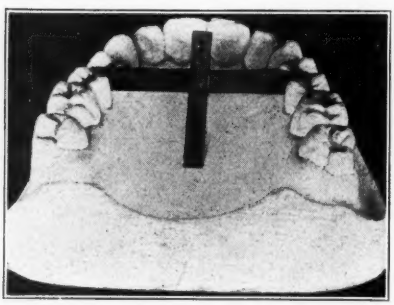

Fig. 9.—Cast (from the case of a boy of 17 years) with measuring gage, proving that, as the result of early orthopedic treatment, the depth of the palatine vault is no deeper than when the patient was 4 years 7 months old.

These defined conditions all require early orthodontic treatment. If the nasal space of the child is not sufficient, the adult will need to resort to surgical interference to improve his breathing.

Every physician, orthodontist or dentist should work earnestly for normal adult dental arches, and should feel his responsibility in protecting the future man and woman from deformities resulting from lack of treatment.

The professional man should teach that the extraction of the permanent teeth of the child for any purpose is always a detriment to establishing for the child, an adult arch, as required to complete the adult frame.

For better understanding, let us divide the dental arch into right and left maxillary and intermaxillary, and study the suture lines in development, as noted (Fig. 2.), the advantages of which will further be described in this report.

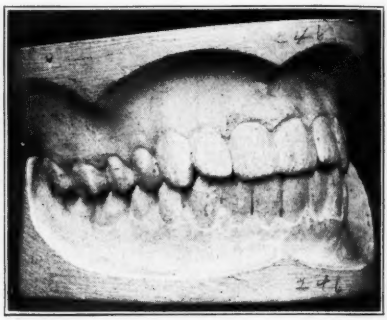

Fig. 10.—Correct occlusion of the teeth of the patient when 17 years of age.

The foregoing principles recommended are verified by the following case, referred to me by a rhinologist, who stated that the child had been badly troubled with nasal stenosis from birth, and that he was helpless as he could not improve the condition of the child by removing any of the tissues.

REPORT OF CASE

A boy, aged 4 years and 7 months, with narrow upper and lower dental arches, and insufficient nasal space (Fig. 3), was taken under treatment, April 8, 1913. From a model of his maxillary arch, the depth of the palatine vault, as shown by the measuring gage in place, from the line of the gingival borders of the arch, measures 15 mm. as seen in Figure 4, with the black mark on the measuring bar resting opposite the lower edge of the cross bar of the gage.

From April 8 to December 8, eight months' treatment, with a removable

apparatus retained with a locking device (Fig. 5), seven applications of limited spring force were applied at intervals for the gradual expansion of the maxillary arch, which brought about a change in the width of the arch of 7 mm. (23 to 30 mm.), with no discomfort. This expansion provided sufficient space for the accommodation of the four permanent incisor teeth.

The lower dental arch, under treatment at the same time, was expanded from 15 to 25 mm., which was a liberal expansion for the free eruption of the lower permanent incisors in line. (Fig. 6.) As the arches further developed, they were harmonized as indicated in Figure 7.

In this case, as in practically all cases of abnormally narrow dental arches in the child, the early treatment for expansion, providing the necessary added space between the cuspids to permit the eruption of the permanent incisors, results in the eruption of the permanent incisors about two years earlier than the recognized normal age for their eruption, at 7 years (Figs. 7 and 8).

These facts regarding the earlier eruption of the permanent incisor teeth, from the early liberal expansion of the arches, either upper or lower, is the general rule for both upper and lower dental arches as early as at 4 or 5 years of age.

Continuing the study of cases having had abnormally narrow dental arches, it is always necessary, in order to complete the scientific study of the case, to continue to watch orthopedically from year to year a certain percentage of cases that require it, to protect the patient and, if necessary, resume expansive treatment for the time.

In Figure 9 is shown the model of the maxillary arch of the case here reported, when the patient was 17 years of age. The use of the measuring gage, as previously described, in measuring the depth of the palatine vault when the patient was but 4 years and 7 months old, demonstrates that the present depth of the palatine vault from the line of the gingival borders of the gum margins, as indicated by the black mark on the measuring bar, now as before, rests opposite the lower edge of the crossbar, indicating 15 mm. in depth; and this shows it to be the same measurement as before treatment, when the child was 4 years and 7 months old. The result of our study of this and other cases is an example of the great benefit to humanity that can be derived from early treatment, when necessary. From this orthopedic treatment the early extensive broadening of the dental arches was brought about which, as stated, prevents the palatal processes from extending upward and encroaching on the nasal space. Figure 10 shows the occlusion of the teeth at this time.

In the foregoing, it will be noted that I am particular always to provide, at any age, sufficient space between the cuspids for the free accommodation of the four incisors, and it is *necessary* that the apparatus be so designed as to sustain this space between the cuspids in the lateral maxillary divisions of the arch, continually, until the bone becomes sufficiently dense to sustain them.[1]

1. The remainder of this report was published in THE JOURNAL, in October, 1922, p. 841.

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C. N. JOHNSON, Editor

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Editorial

THE AMERICAN PUBLIC HEALTH ASSOCIATION

The American Public Health Association is a national organization which should enlist the interest of every individual who is in any way connected with the problem of conserving the health of the people. Every dentist, therefore, should know something about it, and should join it if at all possible. The dues to the individual are five dollars a year, and for this, in addition to the privilege of attending and taking part in the meetings, he gets the monthly journal containing the papers read before the annual sessions as well as interesting articles on health topics.

The association takes in health workers of all kinds, and has various sections, such as those on health officers, child hygiene, public health nursing, food and drugs, sanitary engineering and public health education. The Child Hygiene Section makes an appeal not only to the physician but also to the dentist, dental hygienist, nutritionist, mental hygienist and the teacher.

A president is elected annually, the present incumbent being Dr. Herman N. Bundesen, formerly commissioner of health of the City of Chicago. There is an executive secretary, who is the permanent executive officer of the organization, and an executive committee and a governing council, made up of the officers and chairmen of the various sections, and a certain number of elective members. Practically all important business comes before the governing council, the executive committee acting in an ad interim capacity between the annual meetings. There are also various standing committees and section committees.

In recent years, there has been a very encouraging disposition on the part of dentists, and particularly those prominent in the American Dental Association, to take an active interest in matters of public health, and this tendency should be encouraged in every respect. Not till dentistry is linked up in a concrete way with other health and educational agencies shall our profession function to its fullest possibilities, or shall we be known as a calling of any breadth.

An added incentive for dentists to join the American Public Health Association is a recent movement on the part of this body to inaugurate a nation wide survey of community dental service. Action was taken at the last meeting of the association in Cincinnati to organize such a survey, and at the meeting of the American Dental Association in Detroit, a resolution to cooperate in this survey was passed. Plans are now under way, headed by Mr. Michael M. Davis of the American Public Health Association, to consummate this project. When an organization of this scope interests itself in a matter so strictly dental as this, it is indicative of the significance of dental service as it appeals to the public mind, and we as a profession must rise to our opportunities and assist in every way possible.

This one movement of the American Public Health Association should be sufficient to enlist the active interest of the dental profession, at least to the extent of taking out memberships by individual dentists all over the country. Ample return for the five dollar annual membership fee will be realized in the contents of the official organ, which appears monthly, even if the member does

not attend a meeting. There is no angle of public health service that is not at some time discussed in this publication, and every man interested in any way in health matters should have access to it.

The executive offices of the Association are located at 370 Seventh Avenue, New York, where dentists may write for any information that they may desire.

FEAR

Fear is the greatest handicap of humanity—the worst enemy man ever had. Fear, the handmaiden of ignorance, is responsible for most of man's misery. Fear is a heritage from the caveman, when brainlessness joined with the forces of nature to paralyze the senses of the poor benighted mortal who quaked at the terrific flash of lightning and the appalling sound of thunder. The howl of wild beasts and the roar of the hurricane; the sting of the adder, and the pinch of cold and hunger; the hurtling of rocks down the mountain side, and the cruelty of the raging torrent; the falling tree, and the club of the enemy—all of these combined to put fear in the heart of humanity.

And then as soon as man began to think, the bane of superstition seized him and bound him body and soul. There is no more paralyzing bondage than the terrifying grip of superstition. Compared with this, the manifest forces of nature are soothing and assuring. Superstition has been man's most malignant master, and his worst weapon. He has been frightened by it till he groveled in the dust, and, in turn, he has used it to terrorize others.

Even in our own times, the monstrous superstition of hell fire has thrown a pall over mature men, and has sent innocent little children trembling in an agony of fear to many a sleepless night. The fear of the unknown is more potent than the fear of the known, and thus superstition has held relentless sway over the minds of men wherever ignorance hid the torch. He who dispels a superstition is a benefactor; he who fosters one is a monster. Take superstition and its consequent fear out of the consciousness of man, and humanity would blossom like a flower.

Fear is the most fatal folly in the world and the most senseless. Most of the events we fear never happen, and thus we not only handicap ourselves but we also waste much needless energy. To be fearless is to increase efficiency, and encourage progress. Fear has done more to hold man back from achievement than it has to shield him from injury—more to paralyze him than to protect him. Fear is destructive and disintegrating; it never builds or produces anything. Fear is the greatest accomplice of calamity. It stalks with malicious mien beside the undertakings of men, and casts a shadow over the sunniest enterprise. It causes men to stop just before they reach the summit, to falter when the goal is in sight.

Fear has no ennobling virtue—no constructive urge. It plants its palsied hand on every eager impulse, and withers with its baneful touch ambition's fruitful growth. It sows the seeds of dread and doubt, and waters with its tears the weeds of wretchedness and grief. It chants a dirge on every hopeful plan, and casts a pall on every happy heart. It grips with fiendish glee the fairest flowers of youth, and turns the tide of childhood's happy dreams to agony and doubt.

The duty of every man is to discountenance fear, and drive it from the world. Not till fear is banished from the minds of men shall humanity come fully into its own, and the earth be turned to heaven. Not till fear is gone shall happiness reign supreme.

THE HOUSE OF DELEGATES

This is the season of most of our state meetings, and there is one function of our state organizations to which the attention of the members should be called with some insistence. This is the appointment of delegates to the parent body. Every year, the business of the House of Delegates becomes more important and exacting, and if this business is to be properly conducted, it can be done only by men who have the proper qualifications. State organizations should exercise the greatest care in selecting their delegates, and, if possible, each year there should be represented

a certain number who have previously served in this capacity. Experience in such service is a valuable asset to any delegate, and this is particularly true as the business of the Association becomes more voluminous and important.

On the other hand, it is equally essential that there constantly be added some new men to be broken into the routine of delegate duty, and trained in the necessities of this important position. To be an acceptable and effective delegate requires not only executive ability but also a certain experience in the particular needs of the organization, and thus our delegate list should contain a percentage of old and of new men. We need the gradual influx of new material year by year for its vivifying effect, and to prevent the inertia of cut and dried policies, which sooner or later become fatal to any organization.

It will thus be seen how important it is that our state bodies exercise unusual care in selecting their delegates, and it is equally important that the delegates, immediately on their appointment, begin a careful study of their duties. To be made a delegate to so important an organization as the American Dental Association means not only an honor but also an obligation, and no man should accept such a position without being willing to devote himself to the best interests of the organization and assume his full share of responsibility for its legislative welfare.

It is in the House of Delegates that the laws are made which govern our great body and where the policies are outlined on which the organization functions through the year, and this fact is of sufficient significance to make every delegate take his position most seriously and prepare himself with the greatest care for the proper performance of his duty.

DO IT NOW

Procrastination is said to be the thief of time, and it may also be stated that it is the murderer of method. Its baneful results fall alike on the just and on the unjust. It is the rust in the machinery of life, the sand in the gears and the brakes on the

wheels of progress. It is the lazy salute of the loafer who beckons to the man who is on his way.

If you have anything that must be done, do it now. Do not dawdle and wonder how a thing should be done—do it. Doing a thing and getting it out of the way is the only method of achievement worth considering. Sharp, definite, precise and decisive action is the surest way to accomplish anything. The man who keeps putting things off for a convenient season never finds any season convenient and ends by doing nothing. Doing nothing in this age of intense mental and physical activity, when so many things are clamoring to be done, is almost a crime; and even if we do not care to call a procrastinating man a criminal, we may at least say that he is a party to a crime.

Do it now, and be ready for the next job, with the sublime assurance that the next job is always waiting for you.

DeWITT CLINTON BACON

(1864-1928)

DeWitt Clinton Bacon, son of Dr. DeWitt Clinton and Louise Knight Bacon, was born at Oneida, Ill., July 13, 1864, and died at the Presbyterian Hospital, Chicago, April 5, 1928, after an illness of less than a month.

His early education was acquired at Galesburg, where his father, who had attained prominence as a surgeon in the Civil War, was in practice. He afterward became associated with a prominent local dentist for study. In the autumn of 1885, he matriculated in the dental department of the University of Michigan, where he completed one year of study. The following year, he entered the Chicago College of Dental Surgery. He was graduated with the class of 1887.

Through his efforts and others of this class, the society later to be known as the Chicago Odontographic Society was formed as an alumni society of that class and college.

He was unassuming in manner, always conscientious and ever alert where his chosen calling was concerned. His activities were not local but extended into state and national society affairs. Perhaps his greatest hobby, which also redounded to the benefit of dentistry, was his life long interest in Delta Sigma Delta Fraternity, for which he served as Supreme Grand Master in 1891-1892. He was a Mason, a member of the Consistory and Shrine.

The funeral service was held in Graceland Chapel, conducted by Wright Grove Lodge No. 779.

Dr. Bacon is survived by his wife, Mrs. Floral King Bacon.

BUREAU OF DENTAL HEALTH EDUCATION

THE PROBLEM OF CONSTRUCTING A COMPREHENSIVE PREVENTIVE DENTAL PROGRAM IN A LARGE COMMUNITY*

By EMERSON R. SAUSSER, D.D.S., Philadelphia, Pennsylvania

WE are all agreed that no official public health plan is complete today without adequate provision for the development of a dental program.

This paper has to do with a discussion of plans for the development of a dental health program that may prove effective in a large community; a dental health program adequate, at least, to meet the needs of the child population.

Such is the aim of the mouth hygiene movement in Philadelphia—to create and develop an organization to be known as the Philadelphia Mouth Hygiene Association, that will fully support, in a scientific and professional manner, the work of planning and ultimately putting into effect a sound dental health program as a part of the official public health plan of the community.

The mouth hygiene movement in Philadelphia is evolved from and directly correlated with a state-wide dental health plan that has been in operation in Pennsylvania for several years.

In January, 1921, the dental division of the state department of health was created. During that year, an organization for the promotion of mouth hygiene and public education throughout the state was developed by the Committee on Mouth Hygiene and Public Dental Education of the state dental society, in cooperation with the dental division of the state department of health, to be known as the state dental health plan. The plan was adopted at the annual meeting of the state society, on April 12, 1922, and, April 13, 1922, C. J. Hollister, who is connected with the state department of health, was made director of the field activities of the Committee on Mouth Hygiene and Public Dental Education of the state society. Under his direction, this plan has been an effective means of cooperation between the state department and the state society. The scheme divided the state into nine zones and called for a general survey of the state supplemented by zone activities and zone propaganda.

In view of the conditions existing in Philadelphia, and of the part each city should play in the state program, the chairman of the Committee on Mouth Hygiene and Public Dental Education of the state dental society called into conference a group of dentists of Philadelphia, Nov. 8, 1922, to consider the necessity of organizing a movement to study the dental problem of the city. It was decided that if the dental problem

*Read before the Section on Mouth Hygiene and Preventive Dentistry, of the American Dental Association, Detroit, Mich., Oct. 27, 1927.

which presented itself to the profession in Philadelphia were to be solved at all, it would be solved through organized effort. So the idea of forming an organization to be known as the Philadelphia Mouth Hygiene Association was unanimously agreed on, and a committee on organization was appointed. After this meeting, the committee discussed the problem, and, March 27, 1923, a circular letter was sent to the dentists of Philadelphia, excerpts from which are as follows:

> Animated by this broader conception of the normal relation of mouth hygiene and dental service to the general problem of public health, a group of dental practitioners recently met as a committee in Philadelphia, to consider plans for an organization that would give practical expression to their views. The result of this conference was the creation of the Philadelphia Mouth Hygiene Association, its scope of activity, as formally expressed in its statement of object, being: "The preservation of health and the prevention of disease through the education of the public in the principles, methods, and practice of mouth hygiene." The management of the Association is to be vested in a board of trustees with appropriate officers and committees. . . .
>
> To emphasize the breadth of its scope and its cooperative policy in relation to other specialized activities in the field of public health, it is provided that the board of trustees shall not be composed of dentists only, but of physicians and interested laymen as well; the intention being to enlist the cooperation of all related interests in a general health movement, of which the Philadelphia Mouth Hygiene Association is to be the leader and organizer.

April 8, 1923, the profession was again circularized, this time with a plea for funds to further the work of the committee. The financial campaign continued through May and June, with occasional meetings of the workers, and resulted in the raising of about $5,000.

In the ensuing months, the committee found itself acting in an advisory and organizing capacity concerning policies and equipment in hospitals, dispensaries, industries, etc.

Feb. 26, 1924, an open meeting was held to arouse interest in both dental and public health fields. The attendance was disappointing from a dental standpoint, although the public health fields were well represented. Later, the scope of the plans was enlarged, and a lay committee was appointed to augment the work of the organization committee. This committee held several meetings, and, in joint session with the dental organization committee, advised a general survey of the dental facilities and dental needs of Philadelphia. A survey was accordingly made during the Spring of 1925 by Michael M. Davis, Ph.D., and Clare Terwilliger, R.N., of the Committee on Dispensary Development of the United Hospital Fund, New York City. It was completed June 1. Surveys of New York and Chicago had been made previously under similar auspices. As a result of the survey, the need of more extensive plans became obvious. It was manifestly necessary to make closer contacts with the official health and educational authorities, unofficial health and welfare groups, hospitals, dispensary workers, etc.

The work progressed rapidly until interrupted by the Seventh International Dental Congress. In resuming the original work, the committee found that the project had developed to such a point that it was expedient to engage a worker conversant with the dental problem in the country. In consequence, negotiations were carried on with the American Dental Association to enlist the services of the Department of Dental Health Education. The committee realized that the American Dental Association could not at this time adopt a definite policy

of rendering service of this kind to the profession and the public; yet, the matter was received by the Secretary of the Association in a generous spirit, and arrangements were made whereby the services of Miss Evelyn C. Schmidt, director of the Department of Dental Health Education of the American Dental Association, were allocated to Philadelphia. The work, which consumed several weeks, was completed in March. Miss Schmidt's services were invaluable to the committee, and, in a short time, the program was rounded out to a definite form. A different perspective of the plan in Philadelphia was given the committee and several fundamental phases of the problem, yet to be developed, were pointed out.

One phase was concerned with establishing a workable cooperation between the official health and educational authorities of the state and the corresponding official groups in Philadelphia. Oct. 14, 1927, the Public Health Advisory Committee of the state society held a conference with the secretary of health of Pennsylvania and, among other things, discussed with him the situation in Philadelphia. The cooperation of the dental division was assured, if desired by the authorities in Philadelphia. This offer was received cordially by the official health and educational authorities of Philadelphia during the week of October 17, so that cooperation between the state and municipal authorities is secured; and the Philadelphia activities were definitely correlated with those of the state-wide plan.

Another phase of fundamental importance has to do with developing within the profession the degree of cooperation essential to the success of the plan. The committee has worked out plans that are approaching this problem from two avenues. One avenue is the public speaking class that was organized by Miss Schmidt during her stay in Philadelphia. The class has proved a successful venture in developing material for the association's public speaking bureau. The other avenue through which the necessary cooperation is to be developed is as follows: Philadelphia is divided into ten zones or districts by the board of education. This zoning plan will be adopted by the mouth hygiene association. In each zone, there will be a zone director who will be responsible to the dental director in the central office. The ten zone directors, the dental director and the dental members of the board of trustees of the association, together with other men that it may seem advisable to include, shall comprise the dental health council, which shall act as a dental advisory body to the Philadelphia Mouth Hygiene Association and to the city board of health. Each zone director will be the chairman of a diminutive mouth hygiene association in his zone. Each will have two committees under him: a dental committee and an advisory committee. The dental committee will consist of a dental representative from each ward of that particular zone; and the advisory committee will consist of the school district superintendent, the school district physician, the school district nurse, a representative of the visiting nurses' association, women's clubs, service clubs and such other key people as may be necessary to make up a representative group. The plan should be possible of execution if the dental division at work in Philadelphia uses the methods that have been successful under the state plan.

The committee has consumed a vast amount of time and labor in preparation for its program; for it is convinced of

the fundamental necessity of the effort. For instance, in analyzing a chronological survey of the public dental health work in Pennsylvania prior to 1920, we found that, although the state society has been, since the inception of the first committee on mouth hygiene in 1901, actively engaged in the public health field of this state for nineteen years, and has contributed in no small degree to the health of the state, being a tremendous force in the molding of public opinion along the lines of health, more organization was manifestly needed. When, in February, 1920, the state gave official recognition to the dental activity, there was a noticeable impetus given to the program. Shortly afterward, the dental division was created, in January, 1921; the dental hygienist bill passed in March, 1921, and two dental hygienist schools opened in the state in September, 1921. In the same year, a workable cooperation between the dental division and the state society was established, and a state plan for dental health was adopted, April 12, 1922. There immediately followed a steady and remarkable progress along definite lines of dental public health. Whereas in February, 1920, the work was unorganized with a few exceptions, with only several corrective clinics and no hygienist at work, today there are more than 150 school districts with preventive dental service supported by school funds, with about 200 dental hygienists conducting the work, and with as many more dentists engaged, either part or full time, in preventive and corrective work financed by public funds.

It may seem from the foregoing that excessive time and effort have been spent for a state-wide dental service up to this point—that the ratio of preparation to constructive results has been disproportionate; but when it is realized that public opinion had to be created, without which any official action by state authorities could not be had; that an analogous sentiment had to be created in the minds of the dental profession; that suitable legislation had to be secured, and that funds, both public and private, for the support of the movement had to be secured for the present and assured for the future, those who have had experience in work of a similar character will readily understand and appreciate the amount of preliminary work necessary to secure constructive results.

DISCUSSION

Evelyn C. Schmidt, Chicago, Ill.: Yesterday, Miss Terwilliger spoke on the importance of having a policy, plan, program or, as she said, "whatever means to you a definite course of action" before starting dental service in a community. Today, Dr. Sausser has outlined the inestimable amount of work which is necessary for the development of a plan, and some of the stumbling blocks. It is easy for people to say "Let's have a dental program"; it is difficult, slow and painstaking to develop the idea so that the program will be administratively and fundamentally sound. It is impossible to standardize the procedure for the development of a dental program whether it be a state wide or a community plan. Every state, every community presents its own problem, but there are certain fundamentals which never fail, the most important of which is the fact that organized dentistry in every community and in every state must develop a "public health consciousness" in order that it may cooperate, advise, guide and lead the dental movement as it relates to public health. When I was in Philadelphia, I found great interest in and enthusiasm for the development of a dental health program. The official and unofficial health and educational agencies were eager to have a plan developed whereby everyone might receive dental education, and the indigent, dental clinical care. But the development of a plan whereby the entrée to and resources of these agencies could be utilized rested with the dental profession. Did the profession

have sufficient interest and vision? That it did is proved by the fact that the Philadelphia Mouth Hygiene Association is becoming a functioning health agency to which other agencies are looking for advice and guidance. It must be noted, however, that in lining up the chain of public health agencies necessary to develop a community dental program, organized dentistry is often the weakest link. Dr. Millberry said last evening at a banquet that about one-half of one per cent of those attending this meeting come into the section on mouth hygiene and preventive dentistry. Yet it is the vision of preventive dentistry, the consciousness that dentistry is not a mechanical profession but a contributing factor to the health of the nation which calls and beckons. Will organized dentistry answer?

Harris R. C. Wilson, Cleveland, Ohio: I have had some experience in developing dental programs. I feel keenly the constant demand from all of the social agencies and health activities, seeking a broader program in dental health. Naturally, we should turn to the dental society for support and cooperation, but where do we get it? Only a handful of men are really interested in the problems. There is only a small group willing to give some time, effort and thought to the subject. Now if we do not take hold of these things in the very immediate future, other people are going to do it for us, and if they take hold of it, they are not going to let us have control, but they are going to control it in the way they see fit, and it is not going to be easy for the dental profession if other people take hold of their problems. I feel that anything we can do to stimulate activity on the part of the dental profession is well worth our time, but personally I do not know how to get men to feel they can give up the possibility of earning a few dollars and give some time and thought to the public dental hygiene. I will be glad to discuss with anyone any of the problems that I know anything about. The lack of interest on the part of the dental profession has been uppermost in my mind.

W. R. Wright, Jackson, Miss.: I have listened with interest to the detailed report given of the dental program now in operation in Philadelphia. We all realize that each community has its own problems and they must be cared for according to the needs of each, for they are all more or less different. This plan, in a general way, will be adaptable and useful to all communities with like problems. The problem of enlisting the interest of the profession throughout the country, which was referred to by Dr. Sausser, is, in my opinion, the most important thing we have to deal with just now. The Council on Mouth Hygiene and Public Instruction was created primarily for this very purpose. Its efforts have been directed along this line for six years, and we feel that fair results have been obtained with the means at hand. Just now, the most important thing before us is to interest the House of Delegates and the Trustees in making a sufficient appropriation to carry on the work. The Council has made its report to the House of Delegates asking an increased appropriation in order to broaden the work. The Reference Committee reported this item favorably. By request, a special report has been made to the Trustees on the same subject. Yet the increased appropriation has not been granted. I suggest that this Section pass a resolution endorsing the increased appropriation and convey it to the next meeting of the House of Delegates.

Miss Schmidt: May I say this? Dr. Sausser may die of embarrassment, but I do think this remark is due him. For ten years, to my 'knowledge, Dr. Sausser has given any amount of time and energy to the development of the Philadelphia Mouth Hygiene Association. All of this has been outside of private practice and without compensation. He certainly is an outstanding symbol of the very best that can be done in dental circles.

Laurence Leonard, St. Cloud, Minn.: This subject is one of vast interest. It is pathetically true that the dentists of America are not particularly interested in oral hygiene, but rather in large operations that carry a proportionate fee. They are passively interested, but it is difficult to engage their attention and their cooperation. Notwithstanding this, preventive dentistry can be made wonderfully interesting to both the dentist and patient, with a very remunerative return. I have done considerable work along these lines, in my office and in the way of public exhibits, etc. It is easy to enlist the attention of most of the hygienists and ladies' auxiliaries, but it is difficult to engage the attention and cooperation of the dentists themselves. How we may be able to accom-

plish this, it is difficult to say. Perhaps as is being done in Illinois. As I understand it, there is a statute providing that a dentist be on the state board and the municipal boards of health. This gives them an insight into what prevention and health means, and is a factor in educating dentists to their responsibility regarding oral hygiene and health. In conjunction with this, if we had a practical, brief and definite program in book form, available to dentists (such as we have in St. Cloud), which any dentist throughout the United States might use, the profession could present the problems of excessive decay of children's teeth, of prevention and of oral hygiene and health in any locality, to the schools and to organizations in his community.

N. G. Slaughter, Athens, Ga.: In our district society we get program committees to give over their programs at least once a year to dental health education. It seems to me that the general adoption of this plan would stir up a great deal of interest among the dentists in each district.

Stanleigh R. Meaker, Albany, N. Y.: In directing the work in New York State, I need not only information regarding results of research but also the *modus operandi* of getting and applying that information for the use of various communities. Just now especially, the rural problem is with us. I am coming in contention all the time with two groups, our own professional group and the lay public health group, you might call them. The latter are those who are interested but generally poorly informed on professional methods. To illustrate (this was not an occurrence in my own state, but it is typical and no worse than many I have met): A worker in one place who had had considerable success, was asked by a prospective worker in another place, "Just what should we do to start something?" The one asking the question was a dentist. The one of whom he inquired was not. The reply was, "Make school examinations." "How long will it take me to cover a group of about 700 children?" The answer was, "Well, if you work dexterously, you could handle about 100 an hour." Is there a dentist here that can examine 100 children in an hour and give any sort of an examination? That sort of thing would discredit any mouth hygiene program. It is worse than what we too often get now from school physicians or nurses who merely look at the front teeth, or ask, "Are your teeth all right?" As I have said, that advice was given by one who had had considerable success in her community but I do not see how any success was obtained through examinations made in that way. The dentist, I believe, is not going to accept the suggestion for examining children so rapidly. That is just an illustration of misrepresentation regarding what mouth hygiene really is, of what the profession of dentistry can expect if such people are allowed to direct propaganda work in our name. These people are enthusiastic. Let us then, as professional men, who know the ground that must be covered, if we do not know exactly how to cover it, use their enthusiasm and their pedagogic ability to put it over. Let us direct their use of dental procedures and so keep their teaching within reasonable bounds and under supervision of our profession. Boards of health or medical societies do not permit lay workers to direct their public health work. No more should we.

Dr. Sausser (closing): The cooperation of the dentist is fundamental to the development of a community dental health plan. In many localities, the necessary cooperation can be had only through careful study and planning. The colleges and state boards should be a factor in preparing the mind of the student along preventive lines, making him a potential element in the dental health program of his community. Much educational work could be done by the American Dental Association if every state society saw the importance of community dental service in its bearing on the status and development of dentistry throughout the country. A dental group coordinating with social service groups in the promotion of a community dental service affects in a tremendous way the attitude of the public mind towards dentistry as a public health factor. In planning public dental service in any large community, the movement should be organized in the form of a mouth hygiene association composed of public spirited citizens, so that the program decided on can be more easily carried on year by year through the support of the public and as a part of the general health plan of the community. Also such a scheme of organization makes possible effective publicity whereby policies and standardized information can be properly set forth to the best interests of the profession and the public

at large. The Cleveland Mouth Hygiene Association has, through its splendid results, demonstrated the value of placing a dental health program in the hands of a private organization. I have been stimulated in coming here and observing the great interest and activity of this section in the promotion of mouth hygiene as a public health practice.

DENTAL HEALTH EDUCATION*

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THE wellbeing and onward progress of any community will be found to depend mainly on three factors: its spiritual health, its mental health, its bodily health. There are, of course, other factors, such as climate, geographic situation, fertility of the soil and mineral wealth; but these, though contributory, are not essential.

By the spiritual health of a community, I mean its attitude in regard to religion and ethics; by its mental health, its possession of a reasonable standard of cultivation of the intellect by a wise system of education; by its bodily health, its enjoyment of eugenic conditions of life, wherein preventable disease is prevented, while for unavoidable disease and accident, efficient treatment is provided. In any civilized society, this trinity of factors provides an abundant, unfailing supply of topics for discussion. Politicians, philanthropists, social reformers, priests, laymen, doctors, dentists, all try by word or deed to improve, in some direction, one or another of the three.

Were it possible to coordinate all their efforts, Utopia would be in sight. But there are many creeds and a bewildering multiplicity of religions; so too, there is no uniformity of aim, nor agreement on methods among educational authorities. It happens, in consequence, that there has been, and still is, more disputation than cooperation among ministers and teachers.

But there are only two kinds of health, good health and bad health. Everybody wants good health, and measures wisely devised to secure a high standard of bodily health excite little controversy. They meet, as a rule, with a ready acquiescence, even though they add to the grievous burden borne by the unfortunate members of the community who pay the rates and taxes.

Notable and rapid progress has been made in our own time. We have seen come into being state medicine, national health insurance, the ministry of health, all instituted with the purpose of securing for the people those "eugenic conditions of life" that conduce to bodily health. In the endeavor to promote these conditions, many problems had to be faced. The improvement of existing bad conditions was naturally the most insistent. Education of the masses in the principles of personal hygiene was no use, unless they had the means and opportunity to put them in practice. What was the good of telling the virtue of cleanliness to a people who had no water supply? The first thing to do was to give them the water supply; the next, to make the purchase of soap

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a financial possibility. We know that rickets will not occur in children who get plenty of fresh air, sunlight and fat-soluble-vitamin-containing food; but what is the good of the information to poverty stricken people, living in the basements of slum dwellings? Obviously, the first thing to do is to provide decent housing and a living wage.

The authorities have had to deal with things as they found them, and the treatment of disease and defect naturally had first claim on their activities. Epidemics, infectious or contagious diseases, tuberculosis, these and their like called for notification, and the provision of inspectors, isolation hospitals, sanatoriums, medical and nursing staffs, with ambulance and a host of auxiliary services. Arrangements, too, had to be made for the treatment of patients in their own homes.

All such health measures, constantly in practice, have had some effect in educating the public to a sense of their value; so much may be assumed. The question now arises: Are the people ripe and ready for instruction in preventive hygiene? Whether they are, or are not, the time has come for the next great advance. Where we know the causes of disease, we must assault in force the cause. We must educate the public, which values treatment but is indifferent to protective or preventive measures, until danger is imminent. It has been said that the future of medicine lies in preventive medicine. In preventive medicine, there lies great opportunity for the dental profession. Preventive dentistry is the dentistry of the future. The object of this communication is to indicate some of the ways in which those of us who are interested in this phase of our work are trying to educate the public in the importance we attach to the care of the teeth and the observance of oral hygiene. To educate the public is a long business: it demands unremitting, intelligently directed energy. The public must be addressed in simple language, such as is understood by the people. "Lang-nebbit" words and scientific jargon must be reserved for the occasions when we are airing our erudition before our colleagues.

The public may be reached directly through the following mediums: leaflets, pamphlets, books, lectures, cinema and lantern shows, pictures, posters, newspaper article and reports, exhibits at health exhibitions, baby weeks and the like, and by broadcasting.

1. *Leaflets.*—I submit some leaflets drawn up by the Dental Health Education Committee of the Dental Board of the United Kingdom. The effective and judicious distribution of these leaflets is important. Indiscriminate distribution is useless. To reach the right recipients, the help of such agents as nurses, dental hospitals, private practitioners, local authorities, health insurance officials, and associations and societies interested in public health, should be invoked.

2. *Pamphlets and Books.*—Short pamphlets describing and illustrating the work done in school clinics, industrial clinics, dental hospitals, etc., should be produced for distribution to education authorities. A book specially designed to afford teachers in schools such information as will enable them to instruct their pupils is desirable. To this end, a book should deal with: the importance to general health of a healthy mouth, and should contain easily understood and well illustrated chapters describing the mouth, the teeth defects of development, diseases of the teeth, their causes,

No. 2.

THE CARE OF YOUR TEETH.

A sound and clean set of teeth is essential to health and to the appearance of an individual.

To be sound and clean the teeth must be—

(1) Perfectly formed.
(2) Regularly arranged.
(3) Properly cleaned.
(4) Inspected at intervals that dental decay may be detected.

FORMATION.

Perfectly healthy children have well-formed teeth.

That portion of a tooth formed when a child is ill is faulty in structure, and later may be the starting point for dental disease.

Take care of the child's baby teeth; if these are diseased, the permanent teeth will almost certainly become diseased also.

ARRANGEMENT.

Regularly arranged teeth keep clean.

In children, while the bone of the jaw is soft, sucking the thumb or a comforter often causes the jaw to become deformed and the teeth to be arranged irregularly.

A baby of eighteen months old should have hard crusts to gnaw at meal time. This will clean the teeth and help the growth of the jaws.

CLEANLINESS.

Starchy food (bread, potatoes, etc.) lodged in the crevices between the teeth, decomposes and forms acids. These are the cause of the first stage of the decay of the teeth.

Therefore, clean the teeth regularly, and specially at night, since during sleep decomposition takes place more readily.

There is a right and wrong way of cleaning the teeth. All the surfaces of the teeth should be cleaned and the remains of the food removed from between the teeth, by moving the brush upwards and downwards.

INSPECTION.

The teeth should be inspected by a dentist at least every six months.

The child's teeth must be watched to see they "come" properly.

Decay must be found early, so that the holes may be stopped painlessly while they are small.

If decayed teeth are not attended to, abscesses may form and the mouth become the breeding place of germs. Many serious diseases, which could and should have been prevented, are directly due to this.

Issued by the Dental Board of the United Kingdom,
44, Hallam Street, London, W. 1

prevention and treatment, diseases of the gums and periodontal tissues.

3. *Lectures.*—An interesting lecture with a good set of lantern slides, if well delivered by an experienced lecturer, is effective, and should be widely used. There should be available for lay lecturers the text in full of several lectures, with sets of slides, adapted for delivery, to audiences of different kinds. Dentist lecturers, who do not wish to deliver a printed lecture, should be allowed to select from the catalog of a large collection of lantern slides those suitable to illustrate their lectures.

Lecturers have no lack of topics on which to discourse, among them the following: importance of a good set of sound teeth in the maintenance of general health, good digestion, assimilation and nutrition; the dangers arising from diseased conditions of the teeth and gums, (1) immediate and (2) remote, as, for example, (1) tonsillitis, sinusitis, pharyngitis, and adenitis, (2) septic

pneumonia, bronchopneumonia, meningitis, gastritis, neuritis, arthritis and toxemias due to septic foci; prophylaxis: antenatal care of mother: diet, vitamins, importance of milk, fresh fruit, wholemeal bread; breast-feeding, best for development of teeth and jaws; permanent molars, and thereafter, dental inspection twice a year, with any treatment needed, correction of irregularities, necessary extractions; in adults, regular inspection and treatment, fillings, etc., diet, cleanliness, scaling, extraction of unsavable and septic teeth,

No. 3.

TO MOTHERS.

The teeth begin to form before birth.

If the expectant mother is ill, the teeth of her child will be badly formed.

Nurse your own baby. Bottle-fed children often have bad teeth.

Take care of the child's baby teeth, for if the permanent teeth are cut into a dirty mouth they will become diseased.

Clean the teeth every morning, and every night after the last meal.

Brush the teeth up and down, to clear the food from between them. Food lodged in the crevices makes teeth decay.

Let the child eat hard food; hard food keeps the teeth clean.

If the teeth are decayed and dirty, poisons are absorbed into the system and the health suffers.

Much ill-health is directly due to neglect of the teeth.

The child's teeth should be inspected twice a year, so that any holes can be filled while they are small; it won't hurt then.

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no "comforter" to be used, milk, fresh fruit, green vegetables and crust to gnaw; correction of bad habits, as thumb or lip sucking; child-diet, teaching how to clean teeth, eating few sweets, masticating properly; inspection and treatment of milk teeth; at 6 years, care of the permanent dentition beginning with the appearance of the first pyorrhea: maintenance or restoration of function by artificial dentures, dangers of imperfect crown-work, of fixed bridgework, dental ulcers, cancer. A public lecture on oral hygiene might well be a feature of annual meetings of dental associations, and should be included in the program of health weeks.

4. *Cinema Shows.*—For films suitable for exhibition to school children or to supplement popular lectures, we have hitherto been dependent on the enterprise of our American colleagues. For exhibition during the intervals in public cinema houses, we have a series of lantern slides with pictures and "slogans." This method of publicity seems to be of some value.

5. *Pictures and Posters.*—Pending the appearance of an inspired dental artist, we are inviting dentists to submit suggestions for pictorial appeals to the eye.

6. *Newspaper Articles and Reports.*—Newspapers in this country are willing to print reports of proceedings, if they contain matter of general interest and importance. Editorial comment is occasionally accorded, but, as a rule, press propaganda entails heavy expenditure.

7. *Exhibits at Health Exhibitions and the Like.*—A dental health exhibition always attracts much attention. Such an exhibit might include: (1) anatomic specimens, skulls showing (*a*) temporary dentition, complete and perfect; (*b*) permanent dentition, complete and perfect; (*c*) temporary dentition, labial alveolar process removed

No. 4.

YOUR TEETH.

To be fit and keep fit should be the aim of everyone who wishes to succeed either at work or at play.

It has been proved that diseased teeth are the direct cause of many serious illnesses, Tuberculosis, Diabetes, even Cancer. Even if not seriously ill, a man or woman with a septic mouth suffers in health. Their skin looks dirty; their breath is foul; they have indigestion; they are languid and always complaining; in a word, they are not fit. One cannot produce the best work if one is below par. Millions of working weeks are lost each year through illnesses due to defective teeth. The loss of production which follows means less prosperity to the country, less profits to the firms engaged in industry, lower wages for the workers.

Disease of the teeth is preventable if the teeth are clean, regularly inspected and decay checked early. If decayed teeth are not attended to, not only is tooth-ache frequent, but abscesses form and the mouth becomes the breeding place of germs.

The care of the teeth must begin early. The child must be suitably fed and cared for that the teeth may form properly. But care of the teeth in childhood is of no avail unless the adult continues to care for them, to clean them regularly. If, unfortunately through neglect, the teeth are decayed, if through lack of cleanliness the gums are festering, then to be without teeth is better than to run the risk of those grave diseases they may cause.

Take care of your teeth; it is worth while.

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to show developing permanent teeth; (*d*) mandibles of infant, child of 6 years, adult, aged edentulous person; (*e*) blood and nerve supply of teeth; (2) models showing (*a*) well developed dental arches with sound, regular teeth, and good occlusion, at various ages, (*b*) various forms of maldevelopment, malocclusion, irregularity and disease; (3) models and specimens showing caries, pulpitis, periodontitis, abscess, necrosis, etc.; (4) models, specimens and illustrations showing gingivitis, pyorrhea, salivary calculus, serumal calculus, etc.; (5) models showing abnormalities, such as cleft palate, harelip, hypertrophy of gum and acromegaly; (6) photographs and illustrations to show results of orthodontic treatment, the relation of the teeth to the accessory sinuses, various diseased conditions of the mouth, such as ulcers, specific lesions, lupus, tubercles, actinomycosis, herpes, leukoplakia and neoplasms; (7) models, specimens and illustrations to show hypoplastic teeth, hutchinsonian teeth, gemmation, impaction, supernumerary and supplemental teeth, etc.; (8) roentgenograms and transparencies showing the teeth and jaws in health and disease; (9) school dentistry: photographs showing the working of a school clinic, charts, records, etc.; (10) the toothbrush, its use (illustrated); (11) posters, leaflets, pamphlets, books, pictures, slides, films; (12) prosthetic appliances.

8. *Broadcasting.*—In theory, a broadcast talk would reach some millions of listeners. In practice, I fear that many, perhaps most, listeners in prefer the music of jazz bands to instructive exhortations, and incline to take off the earphones or shut down the loud-speaker, when educational matter is transmitted. There has also to be taken into account the fact that the General Medical Council views with disfavor the announcement of the name of a registered dentist as the speaker. A talk by "Uncle Dick" or "Aunt Molly" is permissible; its effect is problematic.

The methods described are probably the best now available to promote the education of the public in the principles and practice of oral hygiene. They are the methods by which we try to educate the public by a direct appeal to their senses and intelligence; we class them together as the direct methods of approach. But granting that these methods are widely, wisely and vigorously employed, and more important, favorably received, we must consider to what extent they are likely to advance our ultimate object, the improvement of the bodily health of the nation.

Many may be brought to realize the desirability of carrying into practice all the suggestions on the prevention and treatment of dental disease. They may even be convinced that preventive dentistry is one of the most important factors in preventive medicine. An intelligent community will no doubt accept readily the statements and conclusions put before it. The problem still remains: how are we to insure the general adoption of the prophylactic and curative measures we advocate, in a community of 40,000,000 people, of whom 2,000,000 are unemployed and about 10,000,000 are just above the poverty line; while, for the rest, the struggle for existence is rendered almost desperate by the wellnigh insupportable burden of taxation, required for social services, and the payment of our war debt.

To stand aghast, helpless and hopeless in the face of appalling conditions, is not in our tradition. And so, to the direct method of instruction, we must

add the indirect method: we must provide the means and opportunity for the individual to carry out our instructions in practice.

In this endeavor, much is being done. We begin with the children. We have 700 school dental clinics at which 600,000 children receive treatment in a year. Persons insured under the National Health Insurance Act to the number of 14,000,000 receive, through their approved societies, a proportion (in some cases the whole) of the cost of dental treatment. Large industrial concerns find that the provision of dental treatment for their employes is a paying proposition. In the Service, dental officers attend to the teeth of the men. Dental hospitals and schools, though badly handicapped by want of money, do a vast amount of valuable work.

Progress can be made only if dental associations and societies, health ministries, education ministries, local health authorities, local education authorities, health insurance officials, approved societies, municipal councils, county councils, parish councils, boards of guardians, medical schools, colleges, associations and societies, nurses and nursing associations, employers of labor, labor leaders, food reformers, philanthropists, teachers, preachers, statesmen, politicians, doctors and dentists will, each and all, contribute to a common and coordinated effort.

Thus, and thus only, can effort be crowned by achievement—an improvement in the bodily health of the nation—a people enjoying eugenic conditions of life, wherein preventable disease is prevented, while, for unavoidable disease and accident, efficient treatment is provided.

THE DENTAL HYGIENE PROGRAM IN NEW YORK HEALTH DEMONSTRATIONS*

By LUCY J. CHAMBERLAIN, New York City

THE dentists seemed to enjoy it. They were jolly, companionable, encouraging. Everybody thought it was fun, except one stout youngster. Eyes blinking constantly and body quivering, he stood in one corner of the improvised examination room watching the long stream of his classmates go by. Whenever the school nurse urged him to join the line, his eyes filled with tears and he quivered still more. Tactfully the nurse desisted at once, saying, "We'll let him stand there a bit longer watching the others, until he is sure the dentists will not hurt him." Aside, confidentially, she explained that the boy's teacher had told her that he was under treatment for some nervous disorder and that at home discipline was so strict that the boy was at times well nigh uncontrollable in school. "Ready now, son?" the nurse would ask now and then. "Have you picked out the dentist you like best?" Sonny did not pick out his dentist, nor did he give in, although all the members of "1 B" one by one willingly opened their mouths for inspection and passed on smilingly, dental charts

*From the Milbank Memorial Fund.

clasped tightly and proudly in their hands. Not even when the tiny first graders passed in review was Sonny moved to action. He was too much afraid, so nobody forced him to have his teeth looked over. But Sonny was the only one out of the 610 children of this parochial school in the Bellevue-Yorkville district of New York City who failed to have his mouth examined.

showed a 100 per cent condition—all teeth in good order and mouth clean. These received white buttons with "100% good teeth" in red letters upon the face, with the congratulations of smiling teachers and envious schoolmates.

This examination witnessed by the visitor during the early part of the month of February was the second of the two

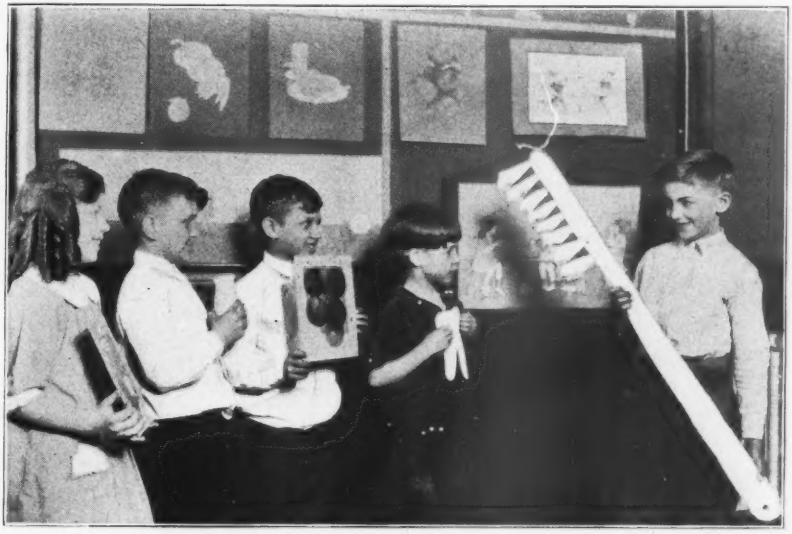

Fig.1.—Children receiving group instruction on the importance of care of the teeth.

One dark-eyed, dark-skinned Italian boy of about 5 years dashed by the visitor, shouting proudly and gleefully to his teacher, "Sister, I have one cavity." A well-poised 6-year-older, blue-eyed and fair-haired, awaiting his turn for examination, said to the visitor somewhat disgustedly, "I have only one bad tooth. It is right in the front and it will fall out soon, anyway." Proud, indeed, were a very few of the children whose charts

conducted in this parochial school by a group of dentists from the Greater New York Oral Hygiene Committee of the city's dental association. For the two examinations during which the mouths of all the children were thoroughly inspected and charted, fourteen dentists volunteered their time and their services. At each examination, eighth-grade pupils, trained beforehand to understand the charts, carefully noted the findings

of the dentists on a separate chart for each child. This opportunity for assisting the dentists had been earned by the older pupils as a reward for 100 per cent clean mouths and sound teeth.

The mouth survey in this school is one of a series of examinations of the mouths of the children of the parochial and public schools in the Bellevue-Yorkville district being conducted gratuitously under the auspices of the Greater New York Oral Hygiene Committee of which Dr. Joseph Kauffmann is chairman, in cooperation with the Association for Improving the Condition of the Poor as a part of the Bellevue-Yorkville Health Demonstration. The dentists who are active participants in the work of this committee are deeply interested in the educational campaigns based upon their findings. The dentists graciously volunteer their services for the initial examination of the mouths of the young school children, while the staff workers of the demonstration and the Association for Improving the Condition of the Poor take the responsibility for the educational and the follow-up work. In this, the two agencies are assisted by the teachers, school nurses and social workers of various agencies in the district.

Fig. 2.—Dental hygienist giving a talk and demonstration to school children regarding care of the teeth.

After a survey similar to the one above described, the next step is to reach the parents of the children to gain their consent for the corrective work. "I wish I'd got a button," exclaimed one small boy wistfully during the above described examination. "You will soon, if you try,"

was the assurance given him. And there is nothing to prevent the boy from early securing his button showing a mouth in 100 per cent condition, unless his parents object to his receiving the dental service offered as a part of the demonstrations by a clinic maintained on a fifty-fifty basis in the Bellevue-Yorkville Health Center Building by the Association for Improving the Condition of the Poor and the Bellevue-Yorkville Health Demonstration. To assure the cooperation of the parents, the teachers of the parochial school in question on the afternoon following the completion of the survey called together all the mothers to consider the dentists' findings. Teachers, school nurse and two special health teachers employed by the demonstration went over the charts with the parents, interpreting the findings. By a conservative estimate, a total of 125 mothers, many of whom had several children enrolled in the school, came to the meeting. Hereafter, each Friday a group of children will be sent from this school to the clinic for corrections. On the final day of the survey, the first group of twenty children attended the clinic in three different installments. This parochial school will earnestly strive for a score of 100 per cent in clean mouths and sound teeth for its children.

In the outer waiting room of the dental clinic, the visitor found a dozen squirming school children. None of them looked afraid. The atmosphere in the clinic seemed very friendly. Some of the children were occupied with attractive pamphlets and other forms of educational literature supplied by the clinic nurse. Those next in line for treatment seemed a little restless but determined. Inside the clinic, a staff of three—a dental hygienist, a nurse and a dentist—were very busy. The hygienist cleaned teeth, while the nurse assisted the dentist with his operations and made out the charts and records. The clinic is operated five days a week from 9 o'clock in the morning to 5 o'clock in the afternoon and on Saturdays from 9 to 12.

Fig. 3.—Clinic of the Bellevue-Yorkville Health Demonstration in New York City.

In this clinic, an average of 600 children are treated monthly. The children come from various sources. Some are referred by the schools. Mothers' clubs hear of the dental clinic and send their children. Some mothers hear of it in the milk station conducted for babies up to 1 year and send their older children. Some children are referred from the dentists. Social service workers carefully investigate the financial status of the families from which the children come to the clinic, and only those children who would not otherwise receive attention are treated. Except in cases in which it is impossible, each child pays 25 cents for each treatment. This small fee is imposed for two reasons. It is felt

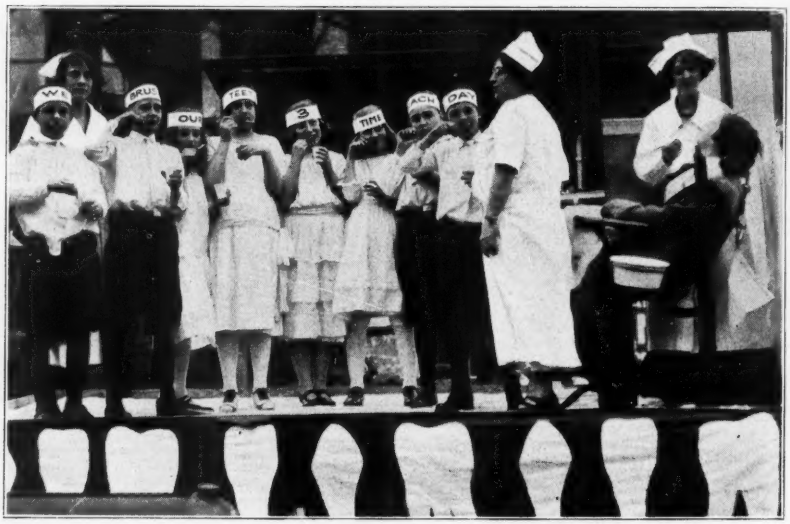

Fig. 4.—Advertising the business of the dentist, care of the teeth. Children in health parade in Syracuse, N. Y., illustrating the work carried out in the schools of that city to impress on children the importance of personal mouth hygiene.

preschool clinic conducted in the Health Center Building for children from 1 to 6 years of age. The social service workers of the churches in the district send in children who are to go to summer camps. The headquarters of the New York City Department of Health send children who are applying for working papers.

Children who can afford to pay for dental service are sent to their family that the payment of even a small fee makes the child feel more self-respecting and more appreciative of the service rendered. The total sum obtained from these fees, although small, does cover the expense of some material and thus helps to extend the dental service. The clinic does not serve adults except on Thursday evenings, when it is open to busy men and women who cannot go to dentists during the day and who are in

strained financial circumstances. These men and women pay at the rate of $4 an hour for service in the Bellevue-Yorkville clinic.

Besides keeping the regular records of service rendered, the clinic nurse has much clerical work to do in line with the follow-up of the children and cooperation with the school teachers. Before any treatment is given a child a "Parent's Consent Slip for Dental Work," approved by a social service worker, must be on file in the clinic. At the first examination, the child presents the chart showing the results of an inspection made by one of the dentists of the Greater New York Oral Hygiene Committee, or, if the child has not been examined, a chart is made on the first examination. Treatment starts. For each future appointment, the child must be excused by his teacher. A request to excuse the child for each appointment is made out by the nurse. The clinic further cooperates with the teachers by marking on a slip the time at which the child reported at the clinic and the time of leaving. To the child a postal card is sent reminding him of the date of his next appointment. If the child fails to keep the appointment, a follow-up card is sent. After an extraction, a child is furnished with a card bearing the following instructions:

CARE OF THE MOUTH AFTER EXTRACTION

Rinse mouth every half hour with a solution of hot water and salt.

Use one teaspoonful of common table salt to a glass of hot water.

Do this at least 6 times.

"A TOOTH BRUSH IN TIME WILL HELP SAVE MY TEETH."

When the dentistry for each child has been completed, the child is given a "Certificate on Teeth" showing that the work has been finished, and a "100% good teeth" button. The child is requested to return for re-examination in from three to six months. A follow-up is sent the child if he does not report. The child is also furnished with two slips. On one the rules for the care of his teeth are graphically and attractively set forth, while on the other, in a similar way, are listed the best foods for building strong teeth.

The dental program of the Bellevue-Yorkville Health Demonstration was developed as a result of a study of the records of the medical inspections given school children in the third grades of all elementary schools in the Bellevue-Yorkville district during the school year 1925-1926. An analysis of the data obtained from this study showed that the children examined were below the physical average of school children in New York City and that the predominating disorder discovered was defective teeth, 64.4 per cent of the children examined showing dental defects.

The results of this study indicated the need for an immediate campaign of oral hygiene educational activities. During the school year 1926-1927, this campaign was begun. The importance of dental hygiene and the need for the correction of dental defects were the points stressed. The project was developed under the direction of the department of health education of the metropolitan health demonstration and a field worker in dental hygiene, supported jointly by the Association for Improving the Condition of the Poor and the demonstration officials. The cooperation of the Committee on Community Dental Service of the New York Tuberculosis and Health Association and of the School of Oral Hygiene of Columbia University was secured. During March, 1927, a squad of twenty-one hygienists conducted the campaign. They cleaned the teeth of the

1,027 children in public school No. 27 and gave thirty-five lectures and toothbrush drills in the schools of the district. The teeth of the children in public school No. 27 were also examined and charted.

To follow up the work of the hygienists, the health workers of the demonstration organized a summer campaign. Eight hundred children from public school No. 27 who lived sufficiently near the Bellevue-Yorkville district to make the work practical were selected. These children were divided into eight teams of 100 each, and each team was divided into groups of ten, with a captain for each group. The campaign began with movies, to which all these children were invited. An educational dental movie was shown and the drive explained, and the captains were selected and given appointments to meet the staff workers the following week. Afterwards, an entertaining movie was shown, and each child was sent home with a card to his parents requesting that he be sent to their family dentist or to the clinic for correction of his dental defects. Competition between the teams was encouraged. The captains worked hard to persuade each of the ten children for whom they were responsible to have their dental defects completely corrected. Special trips were offered for the first two captains who completed their work, and for the winning team, an outing was promised. When the young captains could not persuade the parents of their charges to have dental defects corrected, the health workers of the demonstration staff helped by follow-up cards and visits to the homes of the children. One little girl succeeded in getting twenty children under treatment and came out first place with eleven children with 100 per cent mouths to her credit on the last day of the campaign. A statistical summary of the results accomplished during the fall and summer campaigns showed that 935 of the 1,027 children who had their mouths examined in the spring of 1927 were referred to private dentists or clinics for fillings or other dental work. Two hundred and eighty-two children in this group had treatments, including 156 cases in which all the necessary dental work was completed.

During the present school year 1927-1928, the work has gone ahead. Two of the parochial schools in the district, St. Gabriel's and St. Stephen's, have followed the example of public school No. 27 by opening their doors for dental hygiene campaigns. Both of these are striving for records of 100 per cent sound teeth and clean mouths for their children. Meanwhile, the educational campaign is entering the other schools of the district and the officials of the New York City schools have recognized and welcome the health teachers of the demonstration. Of these, there are four. One general health teacher works with the parochial schools of the district and one with the public schools. The two general health teachers have the first contact with the schools. They work with the teachers, encouraging each to give some part of the school time to health work. They supply the teachers with poster designs, health plays, educational literature, cut-outs and other materials. A third health teacher specializes in nutrition instruction. If a school becomes interested particularly in its dental problem, the health teacher refers the school to the director of dental education, a joint worker of the Association for Improving the Condition of the Poor and the Bellevue-Yorkville Health Demonstration. She at once submits the following statement, entitled, "The School Dental

Problem" to the school interested:

Physical defects interfere with the growth of the body and mind. Bad teeth are the outstanding physical defects of school children. These decayed or abscessed teeth poison the whole system. They may be the direct cause of serious disease. Several demonstrations show that by clearing up all dental problems in a school:

Absences were fewer;
Deportment was improved;
Grades were higher.

Bellevue-Yorkville Health Demonstration suggests the following as ways of attacking your problem. May we talk it over?

1. The children may be taught the need for dental care and stimulated to a desire for it. This may be done by stories, songs, plays, posters, movies and illustrated talks. These may be followed by compositions and stories by the children themselves.

2. Your whole school may be examined by competent dentists and charts made showing the exact defects found. It would take about one-half a day of school time to do your whole school and would be a free service.

3. While all children needing dental care are referred to private dentists if they can go to them, there are always children who must be sent to clinics. We would be glad to help you find the most convenient places for your particular use.

4. You may have a demonstration of the care of the teeth by a graduate hygienist. This may consist of a fifteen to twenty minute talk to individual classes on the essentials only. Or if you would prefer she will give a series of two or three short talks either to classes or assemblies.

5. You may be interested in having a dental contest. If so, we will be glad to help you plan one.

6. Possible projects for some of your older classes:

a. Make posters to illustrate a story on good teeth; this story to be told to the younger grades using the posters made. (We will supply sample stories or the children may use original ones.)

b. Make an exhibit to be displayed in the school. (We would be glad to help you plan one.)

7. There are posters you may borrow, flyers you may give out to your children. Talks or movies will be arranged for you.

The school then makes a choice of a part or all of the program suggested, and the field worker assists in carrying through the plans.

While, perhaps, the oral hygiene program of the Bellevue-Yorkville Health Demonstration has been more extensively developed, dental hygiene activities form an important part of the program of each of the three New York Health Demonstrations in which the Milbank Memorial Fund is cooperating. The year 1927 marked the end of the first five-year experimental period of the rural health demonstration in Cattaraugus County and the urban health demonstration in Syracuse, N. Y. For the metropolitan area in the Bellevue-Yorkville district of New York City, it was the third year. The health demonstrations were undertaken with a two-fold purpose: first, to see what could be done in certain communities to lower the death-rate, control disease and promote health generally by bringing into play in these communities all available experience and scientific knowledge; and, secondly, to discover the unit cost of maintaining effective measures for the prevention and control of disease and for the promotion of individual and community health. Dental disease, being recognized as a very common cause of ill health, the demonstration officials early set up a program of oral hygiene activities, the first step in the plan naturally being an examination of the mouths of the school children in the demonstration areas. The results of the mouth examination survey in the Bellevue-Yorkville district of New York City have already been given. Results of similar surveys in the two other demonstration areas indicated that oral hygiene educational campaigns were sorely needed.

In Cattaraugus County, at the beginning of the health demonstration, a plan was adopted that called for a program of dental hygiene in every school in the county. The carrying out of this plan has not been easy. In the county, there are 299 schools. All but six of these are public schools, and, in size and style, they vary from ten to twelve room modern school buildings in the cities and villages to one room rural schools, the greater number being of the latter type. Factors that have made it exceedingly difficult to enforce uniform standards or to apply a routine school health program to the entire county are the limited equipment of the one room schools and their scattered locations. Two dental hygienists, one employed by the Olean Board of Education, and the other by a group of rural schools in two of the five rural supervisory school districts, comprise the entire dental service staff. The service rendered by them consists of inspection and cleaning of teeth; advice as to having treatment, with subsequent inspections and repetitions of the advice if necessary; and education in oral hygiene.

The dental hygienist for the rural schools has had to divide her time between the two supervisory school districts. From school to school, she has traveled with a portable outfit, consisting of a light dental chair, a foot-engine and the necessary instruments and supplies. In each rural school, she has cleaned the children's teeth, giving prophylactic attention to gums and cavities, and, at the same time, has talked to them about the care of the teeth, placing special emphasis on the proper use of the toothbrush and the necessity of brushing the teeth daily. The hygienist has followed up cases in which extractions and fillings were needed, endeavoring through the pupil himself, the teacher or the parents to get the child under the care of a dentist. In one of the rural schools, the pupils, stimulated by the teacher and the visiting nurse, had all their dental defects attended to before the end of 1926.

In the first survey of the children's mouths, 2,025 pupils in the first five grades of the Olean schools were examined and 821 pupils in the rural schools. An examination several years later, of 387 of the Olean school children whose mouths had been charted in the first survey showed that there had been a reduction of from 23 to 88 per cent in the dental defects of these children except such as imperfect enamel and irregular teeth. The number of children with fillings in their teeth had increased from 29 to 117, and the number of children with normal clean mouths, from one to forty-seven. A similar study of the group of the 821 rural school children also showed improvement but to less marked degree. The fact that the initial examinations of children's mouths show better conditions from year to year, suggests the indirect and educational values of the dental hygiene program of the demonstration.

The public health nurses of the rural health demonstration have recently been drafted to help the dental hygienists check up on corrections. Defective teeth are recorded as corrected only when the recommended fillings or extractions have been taken care of. A great stimulus to the children in securing their aid in the correction of their defects is the gold star project. At the end of each week, a small gold star is pasted opposite the name of each child who has had a satisfactory record for the week. The goal at the end of the year is a gold star of suitable material and size to be sewed on the sleeve of sweater or blouse; and

the conditions on which a gold star is to be awarded are as follows: satisfactory grades in school work; physical defects overcome or treated (including dental defects); satisfactory performance of health habits (such as daily brushing of teeth and washing); satisfactory conduct in school.

In the urban health demonstration in Syracuse, the dental hygiene program is well developed. Three dental hygienists, the school dentists and the school nurse do all they can to awaken the children's interest in the subject of teeth and ways to keep them clean and strong. For children whose parents cannot afford such service elsewhere, two dental clinics are conducted in the Syracuse schools. Two dentists employed by the board of education devote five hours each school day to this work. In addition, three dental hygienists, employed from demonstration funds, clean and chart the teeth of the children, counsel parents regarding the correction of dental defects noted and instruct the pupils individually and in groups on the importance of the care of the teeth.

The oral hygiene programs of the three New York Health Demonstrations do not vary greatly from those being developed in other states as a result of constant stimulation from the American Dental Association. Throughout the country, members of the dental profession are making noteworthy contributions to the public health programs of their communities. Peoria, Ill., in the middle west, and the little city of Athens, Ga., in the south, furnish outstanding examples of successful campaigns of education conducted under the direction or with the cooperation of the local dentists.

The part that the dental profession is playing in the public health movement is a very important one. Special tribute was paid to the work of the dentists in furthering the public health program in Ohio by John E. Monger, director of health of the Ohio State Department of Health, in an address made some time ago before the West Virginia State Medical Society. In part, he said: "Let us be fair about the public health movement. Let us see it as a big thing, in a big way. It is our game. It is distinctly the doctor's game." In another part of his address, in speaking of the effect of the public health movement in Ohio on the private practice of local physicians and dentists in that state, he said: "Every one of these physicians has been financially helped. People now go to them for advice and ask how to keep themselves and their families well. The dentists have been more alive to the situation than we (physicians) have, for they have capitalized community education, and today dentists are doing more dentistry for children than ever before."

PUBLICITY MATERIAL OFFERED BY THE AMERICAN ACADEMY OF PERIODONTOLOGY

As chairman of the publicity committee of the American Academy of Periodontology, I wish to call to the attention of dental organizations that a group of newspaper articles, fifty-four in number, are now ready for distribution. The title of the series will be "Preventive Dentistry." The articles cover practically the entire field of prevention of dental disease so far as the layman is concerned.

The committee, composed of Gillette Hayden, Columbus, Ohio; A. H. Merritt, New York City, and C. H. Schott, Cincinnati, Ohio, arranged the text of the articles and then submitted them to Dr. Herben, former publicity writer for the New York Tuberculosis Association, who rewrote them. They were then submitted to the committee for final cor-

rection and suggestion. The entire group have been gone over by the entire committee. The articles are short and to the point and cover only two typewritten pages, double spaced.

Owing to the fact that we have no reprints, we are offering typewritten "advance copy" of this series for the cost of having the copy made. The series of fifty-four articles, including the cost of mailing, will be $5. For the present, we will supply advance copy to only one organization in a section. After the series have appeared in daily papers we hope to have reprints for free distribution to health workers and reputable organizations desiring them.

Arrangements are now being made to have this group of articles appear in one of the leading morning papers in New York City. By giving this notice through THE JOURNAL, we hope that other sections may have the series simultaneously with this. There will be probably only twenty-five complete sets available at this time.

The series is copyrighted, or will be, and all we ask is that the Academy be given credit and that no names appear with the series other than the local organization, if that is desired. The title of each article follows:

The Teeth of Red Ridinghood's Grandmother.
The Baby's Invincible Pearls.
Mothers Need Not Lose Teeth.
You Are a Banker Before You Grow Up.
Good Teeth to Last a Life Time.
The Horse Shoe in Every One's Mouth.
Why We Have Teeth.
Knowing His Teeth.
Nature Does a Good Engineering Job.
Is Traffic Congested in Your Mouth?
Hanging on to Life by the Teeth.
Nobody Wishes a Mouth Like a Camel's.
Mastication for Good Teeth.
Taking Fifty-Two Chances with One's Life.
The Nerve of a Pulpless Tooth.
Is Your Heart in Your Mouth?
Do Infected Teeth Ever Harm Eyes?
Is Tooth Extraction Ever Justified?
Tartar or Stone in the Mouth.
Say It Without Tears.
Crooked Teeth Are Worse than Bowlegs.
Do You Clean Behind the Radiator?
Could You Take Care of a Bridge?
Could Solomon Understand Tooth Paste?
What an Average Dentist Does Not Want to Do.
Ask Me Another.
Hiding Coin Collection in the Teeth.
Teeth Were Better 25,000 Years Ago.
Tenements in Your Teeth.
Should You Support and Amuse Microbes?
Are You Master of Your Toothbrush?
Why Is a Tooth Ache?
Silver Spoons and Golden Teeth.
Dulling Father Time's Scythe.
Pyorrhea, What It Is.
Can Pyorrhea Be Cured?
Can Pyorrhea Be Prevented?
Ghost Pictures.
Door Knobs and Strings.
Would You Leave Wounds Exposed?
Make Good Your Losses.
Lost Parts.
She Knows How to Wear Them.
"Runnin' De Germ Out De Scenery."
How to Select Two Toothbrushes.
Should One Brush Up?
Silk Is Not Too Good.
Teeth and the Tuberculosis Patient.
Teeth and Cancer of the Mouth.
Is Insanity Related to Bad Teeth?
Is Tooth Ache Increasing?
Does Your Face Ache?
Crooked Teeth and Homely Faces Unnecessary.
You Are at Liberty to Choose.

Any dental organization interested may receive the series upon the terms named by applying to

C. B. Fowlkes, D.D.S., (Chairman),
2 East 54th St., New York City.

CURRENT LITERATURE

EXTRACTS AND ABSTRACTS

Acute Osteomyelitis of the Superior Maxilla in Young Infants: Two cases of acute osteomyelitis of the superior maxilla in young infants is reported by Murray H. Bass (*Am. J. Dis. Child.*, January, 1928). In the first case, seen when the child was 3 weeks old, the first symptoms noted were redness of the left eye and puffiness of the tissues about it. About a week later, pus was noted in the mouth. The general condition was excellent. The left cheek was much swollen and the area below the eye was red, hot, shiny and tender. Pressure caused exudation of pus from the nose and from a small opening in the outer sides of the left superior alveolar process about where the cuspid should be. A probe could be introduced for 2 cm. Transillumination failed to show any difference between the two sides. When the light was placed over the antrum externally and the roof of the mouth was inspected, the left side was seen to be dark. Intranasal illumination failed to reveal the opening of the sinus. Culture of the pus show *Staphylococcus pyogenes-aureus*. The sinus was probed daily, and on one occasion, two small teeth were discharged. A few days later, the reddened area was incised as it seemed to be pointing and the patient looked worse. A small rubber tube was inserted, and through this, the cavity in the maxilla was irrigated for the next three weeks. The condition gradually improved. Two months later, there was little discharge, but several small sequestrums of bone were removed. The wound healed perfectly, but for some time drainage of pus continued. The general condition continued to be good and gain in weight was steady and normal. Appearance of the teeth was normal except in the affected areas. At the age of 4 years and 7 months, the lower teeth were normal; and the five right upper teeth were normal, as were the two left upper incisors. In addition, there was an imperfect bicuspid and the two molars were missing. There were no defects of the bones. In the second case, in a girl, aged 10 weeks, the child was extremely ill when first seen. A swelling above the margin of the upper right gum had been incised and pus obtained. An area of swelling in the roof of the mouth ruptured spontaneously; the inflammation spread to the eye and a purulent discharge occurred from the right nostril. The tissue about the right eye was edematous and red, and the eye was closed. The skin over the upper part of the right cheek was red and swollen. There were two sinuses, one at the right upper alveolar border, where the cuspid should be, and one in the midline of the hard palate. A blood culture and a pus culture showed *Staphylococcus aureus*. Treatment consisted of frequent cleansing of the eye and dilatation of the oral sinuses to prevent their closing. Two new sinuses appeared after the child entered the hospital, one, on the right side of the hard palate near the posterior border, and the other at the juncture of the lip and the alveolar border. The four sinuses discharged pus freely, and when probed, discharged small sequestrums but no teeth. The condition gradually improved until all sinuses were closed, and the general condition returned to normal. The author states that he can find no reference to the condition in American literature. Of the twenty-four cases found in foreign literature, six resulted fatally. The evidence points to the fact that the condition is a disease of the bone itself and not of the maxillary antrum.

Coagulation Time of Blood During Anesthesia: In an attemput to elucidate the causes of pulmonary embolism following operation, Rabinovich (*Brit. J. Exper. Pathol.*) investigated the coagulation time of blood during the operation. In operations under closed ether anesthesia, there is a diminution in the coagulation time of blood in 80 per cent of cases investigated, reaching up to 40 per cent of the initial coagulation time. The diminution is already present during the initial stages of the operation of 75 per cent of cases, and

seems to be independent of the type of operation or duration of the anesthesia. Subcutaneous injection of ether is followed in a majority of cases by an increased coagulability of the blood within half an hour. The coagulation time diminishes slightly with advancing age, within the limits of the data obtained. The increased coagulability does not increase with advancing age, and is not greater in cases involving the opening of the abdomen.—Abstr. *J.A.M.A.*, Jan. 7, 1928.

Effect of Anesthetics on Hepatic Function: In a study undertaken to determine the effects of the administration of various anesthetics on the liver, Rosenthal and Bourne (*J.A.M.A.*, Feb. 4, 1928) reach the following conclusions: Brief periods of chloroform anesthesia are sufficient to produce immediate and delayed toxic effects on the liver; half an hour of chloroform causes injury that requires eight days for functional recovery, while two hours of anesthesia requires six weeks to return to normal. Disturbances of function could be demonstrated with the bromsulphalein test long after pigment metabolism had returned to normal. Ether produces a definite but transitory impairment of function. Recovery is usually complete in twenty-four hours. Nitrous oxid and ethylene administered through a mask did not produce any change in the bromsulphalein test for hepatic function or any disturbance of pigment metabolism. Nitrous oxid and ethylene given in a closed chamber with poor oxygenation caused both immediate and delayed toxic effects on the liver. Cyanosis in itself increases the toxicity of anesthetics on the liver. Large doses of morphin in dogs cause considerable depression of function, with complete recovery in twenty-four hours. Ethylene would seem to be the anesthetic of choice for operation in severe liver disease. It is believed that the changes which anesthetics produce on the liver have a general interest in that this impaired function is only a reflection of the widespread depression of cell activity resulting from certain anesthetics. Analagous changes are undoubtedly produced in most other organs.

Lead Treatment of Cancer: Ullman (*Surg., Gynec. Obstet.*) uses solutions of lead orthophosphate which keep indefinitely at room temperature and apparently do not alter their toxicity with age. He does not believe that lead should, at present, take the place of the time tried methods of surgery and radiation, but should be reserved for those unfortunates who are beyond the reach of either. It is necessary, in order to obtain the maximum benefit, to combine the roentgen ray or radium with the lead injections, and therefore absolutely essential that the user be not only a good clinician but a radiologist as well, or be in close operation with a competent radiologist. He must be familiar with the effects of lead and of radiation, not only on the tumor but on the body as a whole, and must be prepared to combat lead as well as roentgen-ray intoxication. The only direct contraindications to the use of the lead phosphate are a severe anemia and perhaps lung involvement not secondary to breast carcinoma.—*J.A.M.A.*, Feb. 4, 1928.

Increase in Cancer: Certain critics of the modern efforts to check cancer have read failure in the statistics showing increased death rates in the United States. Dr. Francis Carter Wood, one of the foremost specialists in cancer research in the United States, answered one of these recently in the New York *Times*. Mortality statistics for 1926 in 119 American cities showed a mortality rate of more than 100 per 100,000. Such figures constitute a "dismal indictment of the failure of the modern efforts to check the ravages of this dreadful affliction," in the opinion of the critic. Dr. Wood points out first that when a cancer is discovered in a country person, the patient is usually sent to a city, where facilities for care and treatment are better. If the cancer has reached the inoperable stage, the patient can be made more comfortable in a city. This helps to account for the very high death rate for cancer in cities. The second point made by Dr. Wood is that more correct diagnoses of cancer are being made at present than ever before. He predicts that as the ability to recognize cancer increases, the rate will increase and then remain stationary as it has in Switzerland. The rise in rate does not mean that the disease is increasing; it merely shows improvement in the diagnostic ability of the profession. At present, only about 10 per cent of patients consult a physician while the cancer is in a curable stage. Dr. Wood says that it is impossible to reach more than a small part of the population with educational material with the comparatively small amount of money—about $400,000 a year for the whole world—that is available.—*Hygeia*, February, 1928.

Ligation of the Angular Vein in Infections of the Upper Lip: A case of furuncle of the upper lip successfully treated by ligation of the angular vein, after he had lost four patients similarly affected, is reported by C. A. Roeder (*J.A.M.A.*, Jan. 28, 1928). The author states: "Having lost four cases in succession of infections of the upper lip, I felt that a ligation of the angular vein, before the cavernous sinus became involved, would be a procedure of very little risk and possibly of considerable value. As previously stated, prognosis here is perhaps not paralleled in its difficulty and I cannot state that the ligation I performed in the example I am reporting saved this patient from a septic cavernous sinusitis. But I can definitely state that this patient presented a most septic and dangerous appearing upper lip, with a markedly dilated angular vein. I can also state definitely that this ligation did not produce any harm and, during its procedure I felt convinced that I was acting within the realms of good judgment. In a very careful search of the literature, I found two references, after this article was written, of a similar procedure." An incision about one half inch in diameter was made over the left angular vein, starting downward from the level of the inner canthus. The vein was tied between catgut ligatures and cut between. A culture from the lumen proved negative. The carbuncle was then burned out thoroughly with a small point electric cautery. During this procedure, it was found that there was a thick purulent exudate undermining the lip to the midline and extending outward about three-fourths inch beyond the crater of the carbuncle. The entire cavity was thoroughly cauterized, leaving a clean granulating wound forty-eight hours later. Recovery was very satisfactory.

Procain Dermatitis: The most important thing in handling procain dermatitis is to discover the fact that it is a dermatitis due to procain (novocain). After this is done, the condition will rapidly clear up if contact with procain or its salts is absolutely prevented. The patients will recover more quickly if, in the acute stages, bland wet dressings, such as the following, are used: aluminum subacetate, 30 c.c.; water to make 500 c.c. After the acute stage is passed, all that is necessary cream. There is no way to prevent recurris the use of bland ointments such as cold rences except strictly to avoid contact with procain or its salts.—*J.A.M.A.*, Jan. 7, 1928.

Salivary Calculi: A case of salivary calculi of long duration is reported by H. L. Brooks (*J.A.M.A.*, Jan. 28, 1928), in a woman, aged 34. The patient complained of swelling of the floor of the mouth and slight pains radiating to the ear. Mastication was sometimes painful. From childhood, at intervals, there had been a slight irritation under the tongue, and small seedlike substances seemed to exude from the area. At various times, there had been exacerbations of the trouble. The author passed a probe into the lingual duct, under local anesthesia, and felt a hard mass. An incision over the sublingual gland beginning at the duct orifice, permitted removal of two stones, whereupon the swelling and induration disappeared.

Preceptor System in Medicine: Within recent years, considerable criticism has been heard concerning the type of education which is given even by our best medical schools. It is alleged that the students are trained in theory but not in practice; that when they graduate they may be able to conduct complicated laboratory experiments, but they are quite incapable of looking after a sick patient. It would appear that the faculties of certain schools recognize this defect in medical education, for distinct efforts to overcome this fault are being made. In some schools, the students are placed in hospitals as clinical clerks at an earlier stage than formerly. In other schools, a very interesting experiment is being tried. This departure, which is known as the preceptor system, consists in placing a few students with selected clinics or general practitioners, in order that they may come into actual contact with the problems of medical practice. The results of such early attempts in three different universities are related by the deans of these institutions in the *Bulletin of the Association of American Medical Colleges,* for January, 1928. . . . Have we here an innovation in medical education which is going to prove of value, or is it only an ephemeral attempt to correct a faulty tendency in medical instruction? We can hardly visualize such an experiment in our Eastern schools. The greater number of charitable hospitals in the East, with their hugh outpatient departments, offer unlimited material for the teaching of practical medicine. We doubt if the faculty of an Eastern

school would take the pains to hunt up suitable preceptors in the smaller towns and groom them for their jobs. We doubt if the busy practitioner of Middleboro or North Adams would have the time or the inclination to cooperate with the faculty of Harvard, Tufts or Yale for the sake of showing a medical undergraduate the intricacies of his daily routine. Perhaps we are wrong in this; a few years more may see the scheme in full swing. The advantages of such a plan are obvious, provided the preceptor is well trained and conscientious. As Dean Bardeen of Wisconsin says, even the occasional preceptor who illustrates how *not* to practice medicine teaches a lesson. The association of the man in practice with a student fresh from the lecture room and the laboratory should prove to be a stimulation and a pleasure to both. Will it do so? We must wait and see.—*Boston M. & S. J.*, January 12, 1928.

Vincent's Infection: Applications of chromic acid in a 5 to 7 per cent solution, followed in a few minutes by tincture of benzoin is recommended as being both an efficient and soothing treatment. Arsenic may be used in the form of Fowler's solution with equal parts of wine of ipecac, but preferably, I think, neosalvarsan (neoarsphenamin). This can now be obtained in a special ampule for dental use, which is not very expensive, and this is rather a point, as formerly the cost was almost prohibitive when it was used freely. It is commonly employed in a 10 per cent solution. The most popular mouth wash seems to be sodium perborate, a safe and efficient drug, which can be entrusted to the patient and used at frequent intervals. It should be freshly prepared each time it is used, and employed in various strengths from one half teaspoonful in four ounces of water up to applying the dry powder itself. I have used perborate and can speak highly of its value. No instrumentation is used during the acute stage, although the necrotic material may be gently removed and the surface cleaned with peroxide before applications are made. In the more severe cases, where the ulceration is deep and widespread, topical applications and mouth washes do not go deep enough to stop the process. These cases usually receive intravenous injections of neosalvarsan, which stops the process very promptly. Some doubt as to the specific action of the drug may be cast by such a case as is reported by Hilkman and Driscoll, where a Vincent's infection broke out in the midst of an active arsphenamine treatment. In this case, tartar emetic, 5 c.c. of a 1 per cent solution, was used intravenously, with prompt results. I have had one similar experience, a definite Vincent's infection of the mouth appearing after the third injection of neoarsphenamine. In passing, it may be observed, that in this case the smear contained comparatively few spirochetes, although the fusiform bacilli were very numerous. While the intravenous therapy may be necessary to clear up the acute process, the final round up of the treatment of those cases starting in the gums is in the hands of the dental surgeon. After the acute process has subsided, and the smears are negative for Vincent's, it is felt that corrective measures should be instituted to prevent recurrence. This includes such procedures as removing all rough spots from the teeth and fillings, removal of defective crowns and bridges, and extraction of roots and impacted teeth. Some cases of Vincent's, probably most of them, can be cured by the dental surgeon. The more advanced and widespread cases require the aid of the physician, especially for intravenous therapy. To both dentist and physician, the clinical laboratory offers its aid in the very important matter of diagnosis, but its reports must be interpreted in the light of the clinical symptoms.—R. H. Knowlton, in *Bull. Florida State Dent. Soc.*, January, 1928.

Anorexia: In an analysis of 1,471 cases seen in an outpatient department of a group of 349 malnourished children having subjective anorexia (loss of appetite), Walter M. Bartlett (*Am. J. Dis. Child.*, January, 1928) reaches the following conclusions: More than one third of the children with chronic anorexia do not have an organic pathologic condition underlying the symptom. The most common pathologic conditions found associated with chronic anorexia are septic tonsils and adenoids. [Other pathologic conditions most commonly associated were acute infectious diseases; tuberculosis; pyelitis, and dental caries.] Anorexia far exceeds all other presenting symptoms in its incidence in children seen in the outpatient department. The most efficient and reliable method of treatment for chronic functional anorexia is the introduction of fresh calf's liver, broiled beefsteak and lamb's kidneys into the diet.

Cancer of the Lip: The series of cases of cancer of the lip here reported (Trueheart in *J. Kansas M. Soc.*, October, 1926, XXVI, 311-313) were treated at the Sterling Hospital, Sterling, Kansas, between August, 1922 and January, 1925. The treatment consisted of external irradiation of the lip, insertion of needles being applied only in those cases in which the glands were palpably involved. In the ordinary case with small lesion of the lip, the author used four needles containing a total of 44 mg. radiant material screened with 2 mm. Cu and 1 mm. Al. The first treatment lasted forty-eight hours and after the resulting erythema subsided (about three weeks) a second treatment of twenty-four hours was given producing a similar erythema. After a second erythema subsided another twenty-four hour treatment was given. This was almost invariably sufficient to cause the lesion to heal. In involved glands, 10 mg. needles were inserted and allowed to remain for ten hours and in addition there was administered an erythema dose of deep roentgen rays over the glandbearing area of the neck. Two of the patients had the upper lip involved and both of these have remained well since treatment. The lower lip was involved in twenty-three cases and of these patients, two are dead, three have had recurrences and the remainder are well. The author's experience with radium in the treatment of cancer of the lip shows that it offers as good a hope for curing this disease as any other method of treatment if used as the primary treatment at the time when the diagnosis is first made. It has the advantage over other treatments of being able to salvage some of the cases that have been operated on or have used paste or roentgen rays without cure. The most important item in the cure of this condition is early diagnosis and early proper treatment.—Abstr. *Am. J. Surg.*, June, 1927.

Shortcomings in Surgery of Cleft Lip: The following innovations are suggested (R. E. Emmett, *Minnesota Med.*): 1. The Brophy wiring may be done in two stages. 2. Postoperative manual stretching of the lip will relieve tension, increase redundancy and prevent its thinning out. 3. The nasal septum may be divided at its base to allow proper elevation of the nasal tip. 4. The prolabia may be used as a prolongation of the columella rather than a portion of the newly constructed lip. 5. Lip tension should be more often relieved by making incisions along the "laughing wrinkle." 6. Cleft lip may be closed in two stages. 7. The delayed-flap method of suture of the palate may be indicated in certain cases, and in every case of failure to obtain union a secondary suture should be made during the second postoperative week.—Abstr. *Am. J. Surg.*, April, 1927.

MISCELLANY

BOOK REVIEWS

The Practice of Periodontia. By Sidney Sorrin, D.D.S., Chief of Periodontia Clinic, New York University College of Dentistry, Periodontia Department New York University College of Dentistry; and Samual Charles Miller, D.D.S., Instructor Periodontia Clinic, N. Y. U. College of Dentistry; Periodontia Department N. Y. U. College of Dentistry; Formerly Instructor of Physiology and Histology, N. Y. U. College of Dentistry. 160 pages; 122 illustrations. Price, $3.50. Published by The Macmillan Company, New York.

This is not a large book but it presents a more comprehensive treatment of the subject than we have seen for some time. The book is well illustrated with many original cuts. A very interesting chapter is that on "Diet and Its Relation to Periodontal Disease," a subject that is not often enough considered. The volume is well printed on good paper and is in its mechanical make up very satisfactory. It will well repay a careful study.

Iconographia Odontologica. By Curt Proskauer. With 186 illustrations. Price, cloth

$10.00, fancy calf binding, $12.00. Published by Hermann Meusser, Berlin, Germany.

This is a work in German, the distinguishing characteristics of which are the unusually large collection of ancient pictures of dentists and dental topics. We do not recall ever having seen so complete a collection as this, and the reproductions are especially well done.

Orthodontic Directory of the World. Fifth Edition, 1928. Edited by Dr. William C. Fisher, 501 Fifth Avenue, New York City.

This book is precisely what it purports to be, a directory of the orthodontists of the world. It has in addition a list of the orthodontic societies. It is sold by subscription but there are usually thirty or forty extra copies which may be purchased for $5.00 a copy by writing Dr. Fisher.

Dental Pathology. By J. L. Dudley Buxton, L.D.S., R.C.S., L.M.S.S.A., Hon. Dental Surgeon, Dental School, University College Hospital; Assistant Dental Surgeon, West London Hospital. 194 pages; 41 illustrations. Price, $2.50. Published by William Wood & Company, 51 Fifth Avenue, New York.

This little book is Volume VII of the Outlines of Dental Science. It deals with such topics as "Inflammation," "Defective Formation of the Teeth," "Caries," "Diseases of the Pulp," "Ulcers," "Alveolar Abscess and Actinomycosis" and "Tumors of the Jaws."

Manifestly in a book of this size, no attempt is made to treat any of these affections in detail, the aim being to give a mere outline, as the name indicates. For the student, or for a quick brushing up on any of these subjects by the practitioner, the book will prove valuable.

Dental Surgery. By J. L. Dudley Buxton. 173 pages; 20 illustrations. Price, $2.50. Published by William Wood & Company, 51 Fifth Avenue, New York.

This, another of the Outlines of Dental Science, is a handy pocket volume on the subject indicated. The illustrations, while not numerous, are representative of the text, and the book will be found very useful for ready reference.

Operative Dentistry. By J. D. Hamilton Jamieson, H.D.D., L.D.S. Ed. Dental Surgeon to the Edinburgh Dental Hospital, Lecturer on Gold Filling in the Edinburgh Dental School, Examiner for the License in Dental Surgery of the Royal College of Surgeons of Edinburgh. 216 pages; 27 illustrations. Price, $2.50. Published by William Wood & Company, 51 Fifth Avenue, New York.

The author very truly says in his preface, "As prevention of oral disease by means of scientific nutrition may be said to be the immediate objective of modern dental research, those who have the privilege of commencing the study of dentistry with the advantage of present day knowledge should endeavor to visualize the dental surgeon of the future as one who will not have to depend upon such material agents as gold, porcelain and vulcanite for his artistic achievements, but upon the development in himself of the power to guide his patient's own life-force in the building of a perfect natural denture. Until this stage has been reached, however, reparative work will have to be done, and operators trained to do it."

This is the whole situation in a nutshell so far as operative dentistry today is concerned, and this book is an honest effort to aid in this situation.

A suggestion is here made to the author that in future editions he eliminate certain terms whose only justification is that they are a relic from ancient nomenclature. The terms "canine" for cuspid, and "premolar" for bicuspid have no logical basis, and the sooner they are omitted from our literature the better. The present volume is a good book even with these terms, but it would be better without them.

NEWS

Fund for Dental Research: The Academy of Stomatology of Philadelphia has allotted the interest on a fund of $10,000 for the next five years to further dental research. The disbursement of the fund is in the hands of a committee consisting of J. L. T. Appleton, Jr., W. A. Jacquette, and N. Leidy, secretary (1614 Locust Street).

Dentist Elected Lieutenant Governor: Paul N. Cyr, Jeanerette, La., has been elected lieutenant governor of the State of Louisiana. Dr. Cyr is a member of the school board of Iberia parish. For twelve years, he acted as a member of the Board of Dentistry of Louisiana, and he is a past president of the state dental society.

Hospital Dental Clinic: The Beth Israel Hospital recently opened in Newark, N. J., has a dental department whose chief purpose it is to give service to those of limited means or those who are unable to pay for dental service. All branches of dental service will be available, for both adults and children. There will also be a bedside service for hospitalized cases. The medical and dental departments will cooperate, and the dental department will keep in touch with social agencies in an effort to reach indigent persons in need of dental care.

Atlanta Dentist Honored: Robin B. Adair, who has practiced dentistry in Atlanta, Ga., for sixty years, was honored with a testimonial banquet recently, by the Southern Academy of Periodontology. Dr. Adair was a member of the first board of dental examiners in Georgia and has been otherwise closely identified with the history of the profession in the state.

Iowa Alumni Honors Dr. Breene: At their nineteenth annual meeting, the alumni association of the University of Iowa College of Dentistry gave a testimonial dinner honoring Frank T. Breene, dean of the college for thirty-four years.

Lions Club Dental Clinic: The Lions Club of Ossining, N. Y., has opened a dental clinic for underprivileged children. Six dentists are cooperating by giving their services.

Monmouth, Ill., Opens Dental Clinic: The Warren County (Ill.) Dental Association recently completed plans for examining the teeth of all grade and junior high school pupils. Examinations will be conducted in all schools and all the dentists of the county will contribute in giving time for the examinations. Record cards are to be kept, and the parents are to be notified as to the work needed, with the suggestion that the family dentist be consulted. It is intended that each child shall have a yearly examination.

Officers of Louisiana State Society: The newly elected officers of the Louisiana State Dental Society, for the year 1928-1929, are as follows: president, L. J. Schoeny, Donaldsonville; first vice president, T. S. Bennett, Lake Charles; second vice president, M. F. Jarrell, Alexandria; secretary, B. J. Lacour, Welsh; treasurer, O. J. Ory, Garyville. The next meeting will be held at Alexandria, March, 1929.

Deaths

Hoggan, J. A. Cameron, Richmond, Va.; School of Dentistry of the Royal College of Dental Surgeons, 1901; died, February 28; aged 50.

Burton, Frederick W., Detroit, Mich.; University of Michigan, College of Dental Surgery, 1919; died, March 11; aged 30. Dr. Burton had undergone an operation for appendicitis.

McDill, J. W., Cleveland, Ohio; Western Reserve University, School of Dentistry, 1898; died, from heart disease, February 28. Dr. McDill was a member of the Ohio State Board of Dental Examiners.

Forbes, F. S., Horicon, Wis.; died, March 28; aged 62. Dr. Forbes had practiced dentistry for forty years.

Griffen, F. M., Manson, Iowa; State University of Iowa, College of Dentistry, 1897; died, February 20; aged 52.

McCurdy, John S., Ft. Wayne, Ind.; Indiana University School of Dentistry, 1888; died from heart disease, March 5; aged 61.

Taylor, H. D., New Castle, Pa.; University of Pittsburgh, School of Dentistry, 1916; died, March 20, from pneumonia; aged 33. Dr. Taylor was president of the Lake Erie Dental Association. He saw extensive service during the World War as a first lieutenant in the U. S. Army.

Couch, Erwin J., Glenbeulah, Wis.; died, March 8, aged 65.

Law, Edwin A., Bartow, Fla.; University of Maryland, School of Dentistry and Baltimore College of Dental Surgery, 1901; died, March 12, from nephritis and heart disease; aged 53.

Huey, Robert, Philadelphia, Pa.; Pennsylvania College of Dental Surgery, 1867; died, March 12, aged 85. Dr. Huey was a veteran of the Civil War.

Hammond, Grace T., Washington, D. C.; Pennsylvania College of Dental Surgery, 1906; died, March 14.

Peeso, Fred A., New York City; Thomas W. Evans Museum and Dental Institute, School of Dentistry, University of Pennsylvania, 1889; died, March 13, aged 69. Dr. Peeso was formerly an instructor in the universities of Pennsylvania and Columbia.

Brady, George C., Oak Park, Ill.; University of Illinois, College of Dentistry, 1904; died, March 8, from a stroke of apoplexy; aged 58.

McDonald, William B., Binghampton, N. Y.; Thomas W. Evans Museum and Dental Institute, School of Dentistry, University of Pennsylvania, 1901; died, March 7; aged 51.

Coon, Lester B., Newton, Iowa; State University of Iowa, College of Dentistry, 1908; died, March 20; aged 42.

Everett, George E., Oak Park, Ill.; Chicago College of Dental Surgery, Dental Department of Loyola University, 1895; died recently, from heart disease; aged 57.

Coltrin, Charles W., Chicago, Ill.; Chicago College of Dental Surgery, Dental Department of Loyola University, 1887; died, March 22.

Boeckman, Henry F., Pasadena, Calif.; University of Southern California, College of Dentistry, 1906; died, February 27, as a result of an automobile accident; aged 47.

Whitney, George W., Medina, N. Y.; Baltimore Medical College, Dental Department, 1907; died, February 25; aged 46.

Zabel, Fred F., Rochester, N. Y.; Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania, 1919; died, December 19; aged 29.

Fowler, H. B., Sheboygan, Wis.; University of Pennsylvania, 1894; died, February 18; aged 63. Dr. Fowler had practiced in Sheboygan for thirty-four years.

Woodcock, A. W., Winchenden, Mass.; Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania, 1898; died, February 17, of angina pectoris.

ANNOUNCEMENTS

CALENDAR OF MEETINGS*

NATIONAL SOCIETIES

American Dental Association, August 20-24, 1928, Minneapolis, Minn.

Alumni Association, College of Physicians & Surgeons of San Francisco, June 22-23, 1928, San Francisco, Calif.

American Academy of Periodontology, August 16-18, 1928, Minneapolis, Minn.

American Dental Assistants Association, August 21-23, 1928, Minneapolis, Minn.

American Dental Hygienists Association, August 20-23, 1928, Minneapolis, Minn.

American Dental Society of Europe, July 30-August 1, 1928, Brussels, Belgium.

American Society of Oral Surgeons and Exodontists, August 17-18, 1928, Minneapolis, Minn.

American Society of Orthodontists, April 30-May 1-3, 1928, Buffalo, N. Y.

National Association of Dental Examiners, August 18, 1928, Minneapolis, Minn.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June inclusive.

May (1928)

Arkansas, at Little Rock (21-23).
Illinois, at Rock Island (8-10).
Indiana, at Indianapolis (21-23).
Iowa, at Des Moines (1-3).
Kansas, at Topeka, (7-9).
Massachusetts, at Boston (7-11).
Missouri, at Kansas City (14-17).
Nebraska, at Lincoln (21-24).
New York, at Syracuse (16-18).
North Dakota, at Minot (8-10).
Pennsylvania, at Altoona (15-17).
South Carolina, at Myrtle Beach (21-23).
South Dakota, at Aberdeen (15-17).
Tennessee, at Nashville (8-11).
Vermont, at Burlington (23-25).
Virginia, at Roanoke (29-31).
West Virginia, at Parkersburg (14-16).

June (1928)

Georgia, at Atlanta (13-15).
Idaho, at Boise (11-13).
New Hampshire, at North Conway (13-15).
Southern California, at Long Beach (7-9).
Texas, at El Paso (5-7).

*Announcements must be received by the ninth of the month in order to be published in the forthcoming issue of THE JOURNAL.

Washington, at Tacoma (25-27).

July (1928)

Wyoming, at Casper (9-10).

December (1928)

Ohio, at Toledo (4-6).

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

Alabama, at Birmingham, June 25, 1928. Secretary, E. W. Patton, 725 First National Bank Building, Birmingham, Alabama.

Arkansas, at Little Rock, June 18-23, 1928. Secretary, C. L. Hunt, 402 First National Bank Building, Ft. Smith, Arkansas.

California, at San Francisco, May 12, 1928. Secretary, O. E. Jackson, 155 Kentucky Street, Petaluma, California.

Connecticut, at Hartford, June 28-30, 1928. Recorder, Arthur B. Holmes, 80 Central Avenue, Waterbury, Connecticut.

Delaware, at Wilmington, June 20-21, 1928. Secretary, W. S. P. Combs, Middleton, Delaware.

Illinois, at Chicago, June 12-16, 1928. Superintendent of Registration, V. C. Michels.

Indiana, at Indianapolis, June 18, 1928. Secretary, J. M. Hale, Mt. Vernon, Indiana.

Iowa, at Iowa City, May 28 to June 1, 1928. Address, Department of Health, Capitol Building, Des Moines, Iowa.

Kentucky, at Louisville, June 8-12, 1928. Secretary, Robert L. Sprau, 968 Baxter Avenue, Louisville, Kentucky.

Maine, at Augusta, June 25-27, 1928. Secretary, G. W. MacKay Millinocket, Maine.

Michigan, at Ann Arbor, June 11-16, 1928. Secretary, J. W. Lyons, 617-621 Dwight Building, Jackson, Michigan.

Minnesota, June 11-16, 1928. Secretary, F. E. Cobb, 601 Donaldson Building, Minneapolis, Minnesota.

New Jersey, at Trenton, June 25-30, 1928. Secretary, John C. Forsyth, 148 W. State Street, Trenton, New Jersey.

North Carolina, at Raleigh, June 11, 1928. Secretary, H. L. Keith, 409 Murchison Building, Wilmington, North Carolina.

Ohio, at Cleveland, June 4-7, 1928. Chairman, Walter A. Loope, 223 Gordon Arcade, West 65th and Detroit Avenue, Cleveland, Ohio.

Oklahoma, at Oklahoma City, June 25-28, 1928. Secretary-Treasurer, Charles A. Hess, Idabell, Oklahoma.

Pennsylvania, at Philadelphia and Pittsburgh, June 20-23, 1928. Alexander H. Reynolds, 4630 Chester Avenue, Philadelphia, Pennsylvania.

Rhode Island, at Providence, June 26-28, 1928. Secretary, Albert L. Midgley, 1108 Union Trust Building, Providence, Rhode Island.

South Dakota, at Sioux Falls, June 25, 1928. Secretary, G. G. Kimball, Mitchell, South Dakota.

Tennessee, at Memphis, June 18, 1928. Secretary-Treasurer, F. W. Meacham, Chattanooga, Tennessee.

Virginia, at Richmond, June 19, 1928. Secretary, John M. Hughes, 715 Medical Arts Building, Richmond, Virginia.

Wyoming, at Cheyenne, June 26-28, 1928. R. S. Moody, Cody, Wyoming.

DELTA SIGMA DELTA FRATERNITY

The forty-fourth annual meeting of the Supreme Chapter of Delta Sigma Delta Fraternity will be held in the Nicollet Hotel, Minneapolis, Minn., Aug. 20, 1928. The Minneapolis Auxiliary Chapter extends to all our members an invitation to be present, with the assurance that all will receive a hearty welcome. The convention will be held in the Land of Ten Thousand Lakes, so do not forget fishing and camping equipment. The first session will be held at 9:30 a. m., and a second session immediately after lunch. Initiatory exercises will be held during the afternoon session. The banquet will be held at 6:30 p. m., in the Nicollet Hotel. Those expecting to attend should notify Brother Ralph Ackley, 1501 Glenwood Ave., Minneapolis, chairman of the Committee on Hotels and Reservations. For general information, consult Brother George Damon, LaSalle Bldg., Minneapolis.

By order of the Supreme Chapter

FRANK MONROE CASTO,
Supreme Grand Master,
Keith Bldg., Cleveland, Ohio

R. HAMILL D. SWING, *Supreme Scribe,*
Elrae Bldg., Philadelphia, Pa.

STATE OF WYOMING BOARD OF DENTAL EXAMINERS

Wyoming Board of Dental Examiners will meet in Cheyenne, June 26-28, 1928. Direct all communications to R. S. Moody, Cody.

I. P. Hayes, *Sec'y-Treas.*
Sheridan

CONNECTICUT DENTAL COMMISSION

The Connecticut Dental Commission will meet at Hartford, June 28-30, 1928, to examine applicants for license to practice dentistry and dental hygiene and to transact other business proper to come before them. For further information, apply to

Arthur B. Holmes, *Recorder,*
80 Central Ave., Waterbury

ALPHA ZETA GAMMA DENTAL FRATERNITY—PHI CHAPTER

Phi Chapter of Alpha Zeta Gamma Dental Fraternity wishes to announce a formal supper dance to be held in honor of the Massachusetts, Rhode Island and Connecticut Alumni chapters at the Longwood Towers, Boston, Mass., Thursday evening, May 10, 1928.

David Cohen, *Grand Master,*
17 Forsyth St., Boston, Mass.

SOUTH DAKOTA STATE BOARD OF DENTAL EXAMINERS

The next meeting of the South Dakota State Board of Dental Examiners will be held Monday, June 25, 1928, at 9 a. m., at the Carpenter Hotel, Sioux Falls.

G. G. Kimball, *Secretary,*
Mitchell

ALUMNI ASSOCIATION, COLLEGE OF PHYSICIANS AND SURGEONS OF SAN FRANCISCO

The annual meeting of the Dental Alumni Association of the College of Physicians and Surgeons of San Francisco, a School of Dentistry, will be held at the college, Friday and Saturday, June 22-23, 1928. Preceding the general sessions, there will be six different special courses given, among them a class in inlays and modern crown and bridge work, conducted by George M. Hollenback, Los Angeles. June 21 will be a day of golf, luncheons and class reunions, and a banquet at the Bohemian Club, Saturday evening, June 23, will be a part of the social side of the meeting. A cordial invitation is extended all ethical members of the dental profession to attend.

Frederick T. West, *Chairman,*
Publicity Committee,
2595 Mission St., San Francisco

AMERICAN ACADEMY OF PERIODONTOLOGY

The fifteenth annual meeting of the American Academy of Periodontology will be held in the Nicollet Hotel, Minneapolis, Minn., Aug. 16-18, 1928. A cordial invitation is extended to all members of the American Dental Association to attend this meeting.

Justin D. Towner, *President,*
1206 Exchange Bldg., Memphis, Tenn.

J. Herbert Hood, *Secretary,*
624 Hanna Bldg., Cleveland, Ohio

AMERICAN SOCIETY OF ORAL SURGEONS AND EXODONTISTS

The tenth annual meeting of the American Society of Oral Surgeons and Exodontists will be held at the Radisson Hotel, Minneapolis, Minn., Aug. 17-18, 1928.

Harry Bear, *Secretary,*
410 Professional Bldg., Richmond, Va.

THE DENTAL HYGIENISTS ASSOCIATION OF THE STATE OF NEW YORK

The eighth annual meeting of the Dental Hygienists Association of the State of New York will be held at Hotel Syracuse, Syracuse, N. Y., May 16-18, 1928. A cordial invitation is extended to dentists and dental hygienists to attend the clinics and literary meetings.

Althea R. Read, *Chairman,*
Publicity Committee,
52 West Chippewa St., Buffalo

BOARD OF DENTAL EXAMINERS OF ALABAMA

The Board of Dental Examiners of Alabama will hold the regular theoretical and clinical examination in Birmingham, commencing Monday, June 25, 1928, at 9 a. m. For further information, address

E. W. PATTON, *Sec'y-Treas,*
725 First Natl. Bank Bldg., Birmingham

MICHIGAN STATE BOARD OF DENTISTRY

The Michigan State Board of Dentistry will hold its next examination for registration of both dentists and oral hygienists at the Dental College building, University of Michigan, Ann Arbor, June 11-16, 1928. The examination begins at 8 a. m. All applications must be on file in the secretary's office thirty days before the date of the examination. For information and blanks, address

J. W. LYONS, *Secretary,*
617-621 Dwight Bldg., Jackson, Mich.

NATIONAL ASSOCIATION OF DENTAL EXAMINERS

The next meeting of the National Association of Dental Examiners will be held at Minneapolis, Minn., Aug. 18, 1928.

GEORGE L. POWERS,
Memphis, Tenn.

STATE OF RHODE ISLAND BOARD OF REGISTRATION IN DENTISTRY

A meeting of the Rhode Island Board of Registration in Dentistry for the examination of candidates will be held at the State House, Providence, Tuesday-Thursday, June 26-28, 1928, beginning each day at 9 a. m. Candidates shall present to the secretary of this board, at least one week before the examination, a written application on a form provided by the board, together with the examination fee of $20.

ALBERT L. MIDGELY, *Secretary,*
1108 Union Trust Bldg., Providence

IOWA STATE BOARD OF DENTAL EXAMINERS

The Iowa State Board of Dental Examiners will meet at the State University of Iowa College of Dentistry, Iowa City, May 28-June 1, 1928, at 9 a. m., for the purpose of examining applicants for license to practice dentistry in Iowa. An examination for dental hygienists will also be given. For further information and application blanks, address the State Department of Health, Capitol Bldg., Des Moines, Iowa. All papers and credentials must be filed with the department at least fifteen days prior to the date of the examination.

H. W. GREFE, *Director of Examinations and Licenses*

NORTHERN OHIO DENTAL ASSOCIATION

The seventy-first annual session of the Northern Ohio Dental Association will be held, June 4-7, 1928, at the Hotel Winton, Cleveland.

WALTER A. LOOPE, *Publicity Chairman,*
223 Gordon Arcade,
W. 65th and Detroit Ave., Cleveland

TENNESSEE BOARD OF DENTAL EXAMINERS

The Tennessee Board of Dental Examiners will meet at 9 a. m., June 18, 1928, at the Dental Department, University of Tennessee, Memphis, for the purpose of examining all applicants who present credentials acceptable to the board of dental examiners. Hygienists will also be examined. Credentials must be brought to the meeting for the examination by the entire board. Applications should be in the hands of the secretary five days before the board meeting. For application and clinical requirements, address

F. W. MEACHAM, *Sec'y-Treas.,*
Chattanooga

DENTAL SOCIETY OF THE STATE OF NEW YORK

The sixtieth annual meeting of the Dental Society of the State of New York will be held at Hotel Syracuse, Syracuse,, May 16-18, 1928. Literary exercises, clinics, exhibits and

sessions of the executive council will be held at Hotel Syracuse. Reservations should be made early with the hotel management. The executive council will convene for the transaction of the business of the society, Tuesday, May 15, at 3 p. m. I. J. Silverman, 541 E. Genesee St., Syracuse, is chairman of clinics. Exhibitors should apply to Daniel Jutton, 405 E. Fayette St., Syracuse, for space.

Essayists taking part in the literary program are: E. C. Kirk, Philadelphia, Pa.; R. H. Volland, Iowa City, Iowa; William E. Harper, Chicago, Ill.; M. M. House, Whittier, Calif.; Chalmers J. Lyons, Ann Arbor, Mich.; Edward Kennedy, New York City; Charles W. Bödecker, New York City; L. A. Timmerman, Amsterdam, N. Y.; M. J. Terry, Albany, N. Y., and S. R. Meaker, Albany, N. Y. Topical clinic discussion and table clinics will be presented. The social program will consist of fraternity luncheons; a dinner with entertainment, followed by a dance, and special entertainment for visiting women.

A cordial invitation is extended to all ethical dentists of the United States and Canada to be present. For further information and programs, address

A. P. Burkhart, *Secretary,*
57 E. Genesee St., Auburn

PENNSYLVANIA STATE DENTAL SOCIETY

The annual meeting of the Pennsylvania State Dental Society will be held in Altoona, May 15-17. Appearing on the literary program are D. L. Singleton, Arthur D. Black, Victor H. Sears, Edward T. Tinker, Hugh W. MacMillan, S. Calvin Smith, DeForest Davis and Alfred C. Fones. A program of clinics will also be given. The first evening will be given over to fraternity dinners, the second to a reception. For hotel rates, apply to John G. Shaffer, chairman of the hotel committee, 122 Fourteenth Ave., Altoona.

J. C. Nugent, *President,*
Altoona

VIRGINIA STATE BOARD OF DENTAL EXAMINERS

The next regular meeting of the Virginia State Board of Dental Examiners will be held at the Medical College of Virginia, Richmond, beginning promptly at 9 a. m., June 19, 1928. Applicants are required to present a certificate from the state board of education showing that they have had one year of academic education equal to one year of college work. Applications, with fee and photograph, must be filed, complete, ten days before the examination (June 19, 1928). For application blanks and further information, apply to

John M. Hughes, *Secretary,*
715 Medical Arts Bldg., Richmond

BOARD OF DENTAL EXAMINERS OF THE STATE OF MAINE

The Maine Board of Dental Examiners will meet for examination of applicants at the State House, Augusta, Monday, June 25-27, 1928. Application, photograph and fee of $20 must be in the hands of the secretary on or before June 16. Application blanks and information can be obtained from the secretary.

G. W. MacKay, *Secretary,*
Millinocket, Maine

DELAWARE BOARD OF EXAMINERS

The next meeting of the Delaware Board of Dental Examiners will be held in the Municipal Building, Tenth and King streets, Wilmington, June 20-21, 1928, from 9 a. m. to 5 p. m. For further information, address

W. S. P. Combs, *Secretary,*
Middletown

BOARD OF DENTAL EXAMINERS OF CALIFORNIA

The Board of Dental Examiners of California will conduct an examination for licenses to practice dentistry and licenses to practice dental hygiene in San Francisco, commencing May 12, 1928, at 8 a. m. The examination will be held in the Native Sons Hall. An examination will be held in Los Angeles, commencing June 16, 1928, for licenses to practice dentistry. This examination will be held at the University of Southern California, at 9 a. m. Complete credentials, together with the required fee of $25, must be in the hands of the secretary at least twenty days prior to the examination. Only cashier's checks and money orders are accepted.

O. E. Jackson, *Secretary,*
155 Kentucky St., Petaluma

MASSACHUSETTS DENTAL SOCIETY

The sixty-fourth annual meeting of the Massachusetts Dental Society will be held in Boston at the Hotel Statler, May 7-11, 1928. At 11 a. m., May 8, Leroy M. S. Miner, dean of the Harvard University Dental School, will deliver a lecture to the general assembly on "A General Consideration of the Problem of Vincent's Infection." The afternoon session will be given over to a program of "teaching clinics," covering operative dentistry, periodontia and oral surgery. It is suggested that tickets of admission be secured in advance as the attendance at most of these clinics will be limited to fifty. Several general clinics will also be given, one of which will be in charge of Robert Box, of Toronto, Canada, who will have for his subject the use of various drugs and of the roentgen ray in periodontia. James Gregory O'Neill, Windsor, Canada, will also conduct a clinic in periodontia. At the evening session, George H. Bigelow, commissioner of public health of Massachusetts, will speak on "The Health Problem of Massachusetts as It Refers to Oral Hygiene." At 10 a. m., May 9, Francis P. McCarthy, M.D., of Tufts Dental School, will speak on "Oral Medicine." Teaching and general clinics will consume the remainder of the day children's dentistry being the principal topic. Thursday, May 10, Theodor Blum, New York City, will speak at 10 a. m. on "Fundamental Problems in Local Anesthesia." Prosthetics will be covered in the day's clinics. C. N. Johnson, of Chicago, will speak at the general session Thursday. The evening will be given over to the annual banquet and dance, W. Warren Giles, East Orange, N. J., being the speaker of the evening. On the last day of the convention, Martin Dewey, New York City, will deliver a lecture on "The Early Diagnosis of Malocclusion and the Advantages of Early Treatment." Clinics will complete the program for the day, and in the afternoon a golf tournament will be held.

NORTH CAROLINA STATE BOARD OF DENTAL EXAMINERS

The next regular meeting of the North Carolina State Board of Dental Extminers will be held in Raleigh, beginning promptly at 9 o'clock, Monday morning, June 11, 1928. For application blanks and further information, address

H. L. KEITH, *Secretary,*
409 Massachusetts Bldg., Wilmington

LIBRARY BUREAU*
BIBLIOGRAPHY ON VINCENT'S INFECTION†
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Akerstrom, S. M.	Effective treatment for Vincent's infection. U. S. Naval Med. Bull. 22:440-443, April, 1925.
Appleton, J. L.	Mouth infections: their symptoms and effects. Med. Jour. & Rec. March 17, 1927.
Barenberg, L. H. & Bloomberg, M. W.	Use of sulpharsphenamin in Vincent's angina and stomatitis in children. Jour. Amer. Med. Assn. 83:25-27, July 5, 1924.

*Formerly the Department of Literary Research.

†This bibliography was hurriedly compiled by the librarian in answer to an urgent request. Because so many requests have been received for material on Vincent's infection, publication of the bibliography seemed expedient.

‡The references in this bibliography were taken from the Quarterly Cumulative Index to Medical Literature for the period covered by the bibliography and from the Indexes of the Dental Digest, Dental Items of Interest, Dental Cosmos, Pacific Dental Gazette and Journal of the American Dental Association. It also includes occasional references from other sources.

Barrett, L. G.	Ulcerative stomatitis. Dental Cosmos 69:346-348, April, 1927.
Bloodgood, J. C.	Oral lesions due to Vincent's angina: what every physician should know about its recognition and treatment. Jour. Amer. Med. Assn. 88:1142-1145, April 9, 1927.
Bloodgood, J. C.	Trench mouth, Vincent's angina. Chicago Dental Soc. Off. Bull., Vol. 7, April 1, 1927.
Bloomberg, M. W.	Ulcerative stomatitis. Dental Cosmos, 69:346-348, Apr., 1927.
Bonney, T. C.	Acute ulcerous gingivitis; its prevalence in the U. S. and the importance of its early recognition and treatment. Dental Cosmos 66:1281-1288, Dec., 1924.
Bowman, W. M.	Vincent's angina or ulcero-membranous tonsillitis; diagnosis and treatment. Virginia Med. Monthly 52:94-98, May, 1925.
Boyens, P. J.	Simple treatment for acute Vincent's gingivitis. Pacific Dental Gaz. 34:204-205, Apr., 1926: also Dental Sci. Jour. Australia, Vol. 6, Oct., 1926.
Burns, E. M.	Vincent's infection; its significance as precursor of pyorrhea, etc. California & Western Med. 25:344-346, Sept., 1926.
Cadham, F. T.	Vincent's disease; infection due to fusospirillary invasion. Canadian Med. Assn. Jour. 17:556-560, May, 1927.
Conrad, A. A.	Vincent's angina. Nebraska Med. Jour. 10:48-51, Feb., 1925.
Corson, G. R. C.	Vincent's angina. Atlantic Med. Jour. 27:820-822, Sept., 1924.
Dabney, S. G.	Typical case of Vincent's angina. Kentucky Med. Jour. 23:248-249, April, 1925.
Daley, F. H.	Vincent's gingivitis in Boston in 1926. Apollonian 2:69-83, April, 1927.
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Effler, L. R.	Vincent's angina. Laryngoscope 37:448-452, June, 1927.
Fain, H. G.	Vincent's stomatitis; its diagnosis, treatment, and prognosis. U. S. Vet. Bur. Med. Bull. 2:601-605, June, 1926.
Fischer, Bercu	Vincent's ulcerative gingivitis as secondary infection. Dental Cosmos 67:682-684, July, 1925.
Fulwider, R. M.	Vincent's angina. U. S. Vet. Bur. Med. Bull. 3:1135-1138, Nov., 1925.
Golob, Meyer	Diagnosis and therapy of Vincent's infection. Jour. A. D. A. 13:639-642, May, 1926.
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Hyde, W. H.	Vincent's angina. Dental Items Interest 47:607-609, Aug., 1925.
Inman, J. C., Jr.	Vincent's infection. Jour. Florida Med. Assn. 13:164-165, Jan., 1927.

Jesser, F. J.	Vincent's angina. Amer. Dental Surgeon 46:201-202, Feb., 1926.
Jones, T. E.	Importance of establishing diagnosis in suspected cases of Vincent's angina. Surg. Clin. North Amer. 4:975-979, Aug., 1924.
Knowlton, R. H.	Vincent's infection. Florida State Dental Soc. Quart. Bull. 7:10-16, Jan., 1928.
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Novak, F. J.	Treatment of Vincent's angina. Amer. Dental Surgeon 46:689-690, Oct., 1926.
Parmesano, L. J.	Three common infections of mouth. West Virginia Med. Jour. 20: 241-244, May, 1925.
Perry, M. W.	Vincent's angina, report of unusual cases. Internat. Clin. 4:32-36, Dec., 1924.
Pilcher, Wm.	Vincent's infection, with report of cases treated. Dental Cosmos 67:1064-1070, Nov., 1925.
Rattner, M.	Vincent's infection. Jour. A. D. A. 11:859-862, Sept., 1924.
Reasoner, M. A., & Gill, W. D.	Use of soap in prophylaxis of Vincent's infection. Jour. Amer. Med. Assn. 88:716-719, March 5, 1927.
Reichman, F. J.	Vincent's infection—acute and chronic. Jour. A. D. A. 13:1665-1674, Dec., 1926.
Reithmuller, R.	Specific treatment of infectious mouth lesions. Pacific Dental Gaz. 34:365-367, July, 1926.
Roberts, E. R.	Unusual case of Vincent's angina. Laryngoscope 34:359-362, May, 1924.
Salman, Irving	Vincent's angina. Dental Digest 32:464-466, July, 1926.
Sampsell, T. L.	Vincent's infection. U. S. Naval Med. Bull. 22:450-452, April, 1925.
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Vonderlehr, R. A.	Case of Vincent's angina treated with antimony potassium tartrate injected intravenously. Virginia Med. Monthly 51:309-310, Aug., 1924.
Wack, Louis	Vincent's angina. Dental Digest 33:879-881, Dec., 1927.
Ware, C. E.	Case of Vincent's angina. Jour. Amer. Med. Assn. 89:450, Aug. 6, 1927.
Westlake, S. B.	Therapeutic and prophylactic value of tonsillectomy in active stage of Vincent's angina. Ann. Otol. Rhinol. & Laryngol. 34:1121-1149, Dec., 1925.

RESOLUTIONS ON THE DEATH OF JOHN F. ZABEL

WHEREAS, Almighty God in His infinite wisdom has taken from our midst our fellow practitioner, John F. Zabel, we, the members of the Rochester Dental Society, who have profited so largely by his association, and by the example of his unflinching valor in the face of adversity, wish to express our deep and sincere sorrow in his loss: therefore, be it

Resolved, that a copy of these resolutions be forwarded to the bereaved family, and a copy of the same be sent to the dental journals for publication, and a copy be spread on the minutes of the Rochester Dental Society.

(Signed) HOWARD F. LEWIS, *Chairman.*
Jan. 11, 1928.

RESOLUTIONS ON THE DEATH OF FRANK THORN VAN WOERT

It is with deep sorrow that the New York Academy of Dentistry records the passing, from its ranks and counsels, of this valued fellow, Frank Thorn Van Woert.

His sterling integrity, his manifest determination to think rightly, to speak fairly, to constantly advance the standing of his profession, and to deal courageously but courteously with all in so doing, were among his notable qualities.

His constant readiness to counsel and help the younger members of his profession was of inestimable value to many such in their developmental years.

His exceptional capacity in executive detail has borne fruit in his later years in the educational field, and there, as in practice, in clinical service and in the counsels of organized dentistry, he has left a shining record of achievement, one that gains additional luster from the fact that his professional education was gained in spite of obstacles that might well have daunted a man of lesser qualities.

With chastened spirit, we enter on our records the passing of a dear friend and counsellor, whose record of over fifty years in our calling challenges emulation.

By unanimous vote, Nov. 28, 1927, the New York Academy of Dentistry directs that the foregoing memorial be entered on its records and that its officers shall transmit copies to the family of Dr. Van Woert and to leading dental journals with request for their publication.

WILLIAM B. DUNNING,
JOHN O'GORMAN LANE,
HENRY W. GILLETT, *Chairman.*

RESOLUTIONS ON THE DEATH OF TRUMAN W. BROPHY

WHEREAS, the members of the California State Dental Association have learned with deepest sorrow of the death of Truman William Brophy, who was taken from this life, Feb. 4, 1928, after a long and useful career of unselfish devotion to the progress of dentistry, and

WHEREAS, his scientific researches and service to the profession have been such that we, his confrères, will continually point to his achievements with pride; and his unassuming, affable and genial personality, his high ideals and strong convictions in those principles in which he believed will keep his memory fresh in our minds; dentistry everywhere will cherish his memory, but the influences he has set in motion among his friends will roll on through the long years of eternity; therefore, be it

Resolved, that a copy of these resolutions be sent to each of the principal journals and to the family of the deceased.

H. T. HENDRICKS, *Chairman,*
B. FRANK GRAY,
LOUIS GRAHAM,
ARTHUR R. MCDOWELL,
J. LORAN PEASE,
ALBERT D. DAVIS.

RESOLUTIONS ON THE DEATH OF FRANK T. VAN WOERT

WHEREAS, it has pleased Almighty God to call unto His vineyard an humble worker, distinguished in our midst, renowned, faithful, loyal to his profession, and beloved by us all, and

WHEREAS, the aforementioned worker, Frank T. Van Woert, was director of our school of dental and oral surgery, which he not only served most faithfully in a directing capacity, but honored by his personal and unremitting activities in the field of betterment for his profession by his pioneering in radiography,

by his developed technic in making what he called "cast gold tips" for abraded teeth, by his experiments with porcelain packed under pressure, and by his contributions on the uses of color photography in the dental profession, and

WHEREAS, our beloved director served us further by imparting his genius to us in a capacity as teacher, for which service we are immeasurably indebted, and indelibly impressed with the knowledge he imparted to us, be it hereby

Resolved, that we as members of the Alumni Association of the School of Dental and Oral Surgery of Columbia University do, in meeting assembled, express our sincere regrets for having lost such a guiding spirit in our midst as was Dr. Van Woert, and express our deepest sympathy to his bereaved family for having lost one so dear to them as well as to us, by formal resolution; and that such be made a part of the regular minutes of this association, and that a copy of same be sent to his family.

RESOLUTIONS ON THE DEATH OF CHARLES ADOLPH

WHEREAS, that Inscrutable Destiny which guides the fate of men has removed from our midst our beloved confrère Charles Adolph, and

WHEREAS, we are greatly grieved by the separation; be it

Resolved, that this action shall in a small measure express our sorrow and sympathy to those who share with us this bereavement; and be it further

Resolved, that this resolution be spread upon our minutes and a copy be sent to the American Dental Association, the Louisiana State Dental Society and the family of the deceased.

CHARLES SHEPARD TULLER, *Chairman,*
RALPH SHERWOOD,
FRANK OSER,
Committee on Resolutions.

New Orleans, La., Dec. 21, 1927.

AMERICAN DENTAL ASSOCIATION

Minneapolis, Minnesota. August 20 to 24, 1928.

HOTEL RESERVATION

The Housing Committee for the American Dental Association meeting in Minneapolis has compiled a roster of hotels approved by the Minneapolis Civic and Commerce Association and the Hotel Association.

Please be accurate in filling out the reservation form below and send it to the hotel of your first choice. You will be advised by the hotel of the receipt and listing of your reservation.

In the event that the reservation of your first choice cannot be made, the hotel manager will forward this blank to the Chairman of the Halls and Hotels Committee. He will place your reservation under either your second or third choice; or, if these are not available, in as favorable a hotel as possible. You will be advised of the name and location of the hotel in which the reservation is made and the hour at which the reservation begins. Rooms not occupied at the designated hour of the reservation may be reassigned by the hotel.

Please remember that a reservation constitutes a contract with the hotel to provide you with the accommodations that you desire. If you find it impossible to carry out your part of the contract, namely, to occupy the room at the time agreed on, please write or wire the hotel releasing it, in order that your room may be made available for other members.

MAIL THIS APPLICATION DIRECT TO HOTEL

HOTEL RESERVATION

AMERICAN DENTAL ASSOCIATION, MINNEAPOLIS, MINN., AUG. 20 TO 24, 1928

.....Hotel.
Minneapolis, Minn.

Dear Sir: Please make reservations noted below:

.....rooms with bath for.....persons. Rate: $.....to $.....per day per room

.....rooms without bath for.....persons. Rate: $.....to $.....per day per room

Date of arrival.....Hour.....

Date of leaving.....

Please note the following second and third choice of hotels:

Second choice.....

Third choice.....

Room or rooms will be occupied by

NAME ADDRESS IN FULL

....

....

Name of applicant.....

Street and number.....City and State.....

Please confirm this reservation to applicant. I further agree to notify the hotel immediately in event I am unable to use this reservation.

Important to hotel manager:—In event that you cannot accept this reservation, please forward this application at once to Dr. W. C. Naegeli, Chairman Halls and Hotels Committee, American Dental Association, 301 Donaldson Bldg., Minneapolis, Minn., who will attend to the assignment of this reservation.

HOTELS and ADDRESS	Rooms	WITH BATH		WITHOUT BATH	
		One Person	Two Persons	One Person	Two Persons
RADISSON 7th St. between Hennepin & Nicollet	500	$3.00-6.50	$5.00-30.00	$2.00-2.75	$4.00
NICOLLET Washington at Nicollet	600	2.50-6.00	4.00-8.00	2.00	3.50
CURTIS 10th St. & 4th Ave. S.	825	2.00-3.00	3.00-6.00		
LEAMINGTON 3rd Ave. S. at 10th St.	500	2.50-4.50	3.50-6.00		
SHERIDAN 1112 Marquette	450	2.50 up	3.50 up	1.50 up	2.50 up
ANDREWS Hennepin & 8th St.	328	2.50-6.00	4.00-7.00	2.00-2.50	3.00-3.50
BUCKINGHAM LaSalle & 15th St.	138	2.50-3.50	4.00-6.00		
CAMFIELD Marquette & 8th St.	100	1.50-1.75	2.50	1.25	2.00
DYCKMAN 6th St. between Hennepin & Nicollet	300	2.00-5.00	4.00-7.00		
FRANCIS DRAKE 10th St. & 5th Ave. S.	160	2.50-5.00	3.50-6.00		
ELGIN Hennepin & 8th St.	125	1.50	3.00 up	1.00	2.00 up
HASTINGS 12th St. & Hawthorne	150	1.75-4.00	2.50-5.00		
MARYLAND LaSalle & Grant	172	2.00-2.50	3.00-3.50		
PLAZA Kenwood Parkway & Hennepin	160	2.50-6.00	3.50-6.00		
PAULY Nicollet & High	48			1.00-1.50	1.50-2.00
ROGERS Nicollet & 4th St.	200	2.00-2.50	3.50-5.00	1.25-1.50	2.50
RUSSELL 16 S. 4th St.	125	1.50-2.50	2.50-4.00	1.25-1.50	2.00-3.00
SENATOR 314 S. 8th St.	80	2.00 up	3.00 up		
ST. REGIS Marquette & 9th St.	58	1.50-3.00	2.50-4.00		
VENDOME 4th St. between Hennepin & Nicollet	250	1.75	3.00-3.50	1.25-1.50	2.00-2.50
WEST Hennepin & 5th St.	362	2.00-4.00	3.00-5.00	1.50-2.00	2.50-3.00

Newgarden, Mark	Vincent's infection. Dental Items Interest 50:29-41, Jan., 1928: also Dental Sci. Jour. Australia p. 127-129, March 1, 1928.
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Resolved, that a copy of these resolutions be forwarded to the bereaved family, and a copy of the same be sent to the dental journals for publication, and a copy be spread on the minutes of the Rochester Dental Society.

(Signed) HOWARD F. LEWIS, *Chairman.*
Jan. 11, 1928.

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His sterling integrity, his manifest determination to think rightly, to speak fairly, to constantly advance the standing of his profession, and to deal courageously but courteously with all in so doing, were among his notable qualities.

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By unanimous vote, Nov. 28, 1927, the New York Academy of Dentistry directs that the foregoing memorial be entered on its records and that its officers shall transmit copies to the family of Dr. Van Woert and to leading dental journals with request for their publication.

WILLIAM B. DUNNING,
JOHN O'GORMAN LANE,
HENRY W. GILLETT, *Chairman.*

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CHARLES SHEPARD TULLER, *Chairman,*
RALPH SHERWOOD,
FRANK OSER,
Committee on Resolutions.

New Orleans, La., Dec. 21, 1927.

AMERICAN DENTAL ASSOCIATION

Minneapolis, Minnesota. August 20 to 24, 1928.

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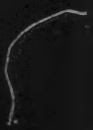
Please remember that a reservation constitutes a contract with the hotel to provide you with the accommodations that you desire. If you find it impossible to carry out your part of the contract, namely, to occupy the room at the time agreed on, please write or wire the hotel releasing it, in order that your room may be made available for other members.